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PILOT'S FLIGHT OPERATING INSTRUCTIONS

FOR

ARMY MODEL

A-36A-1-NA

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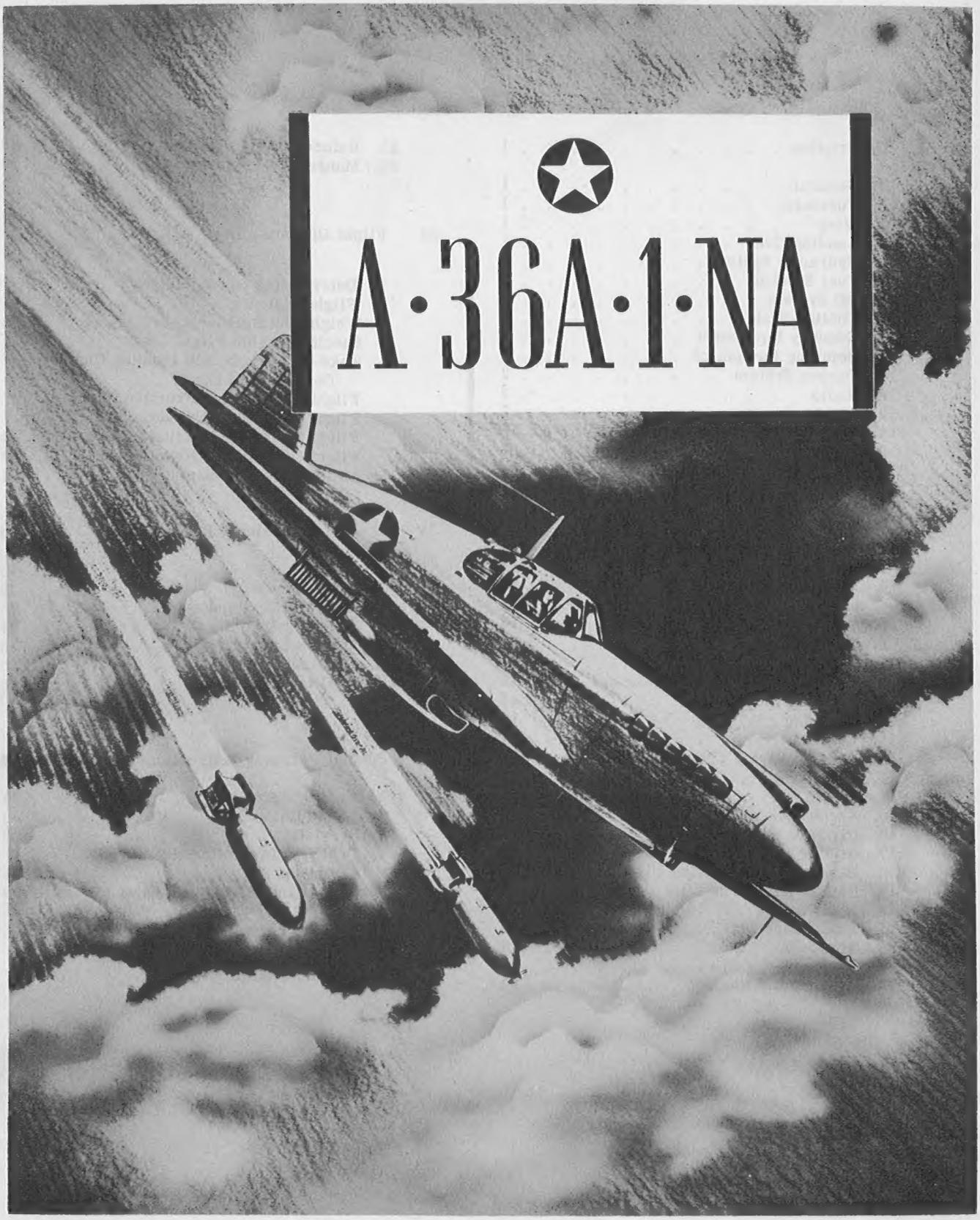
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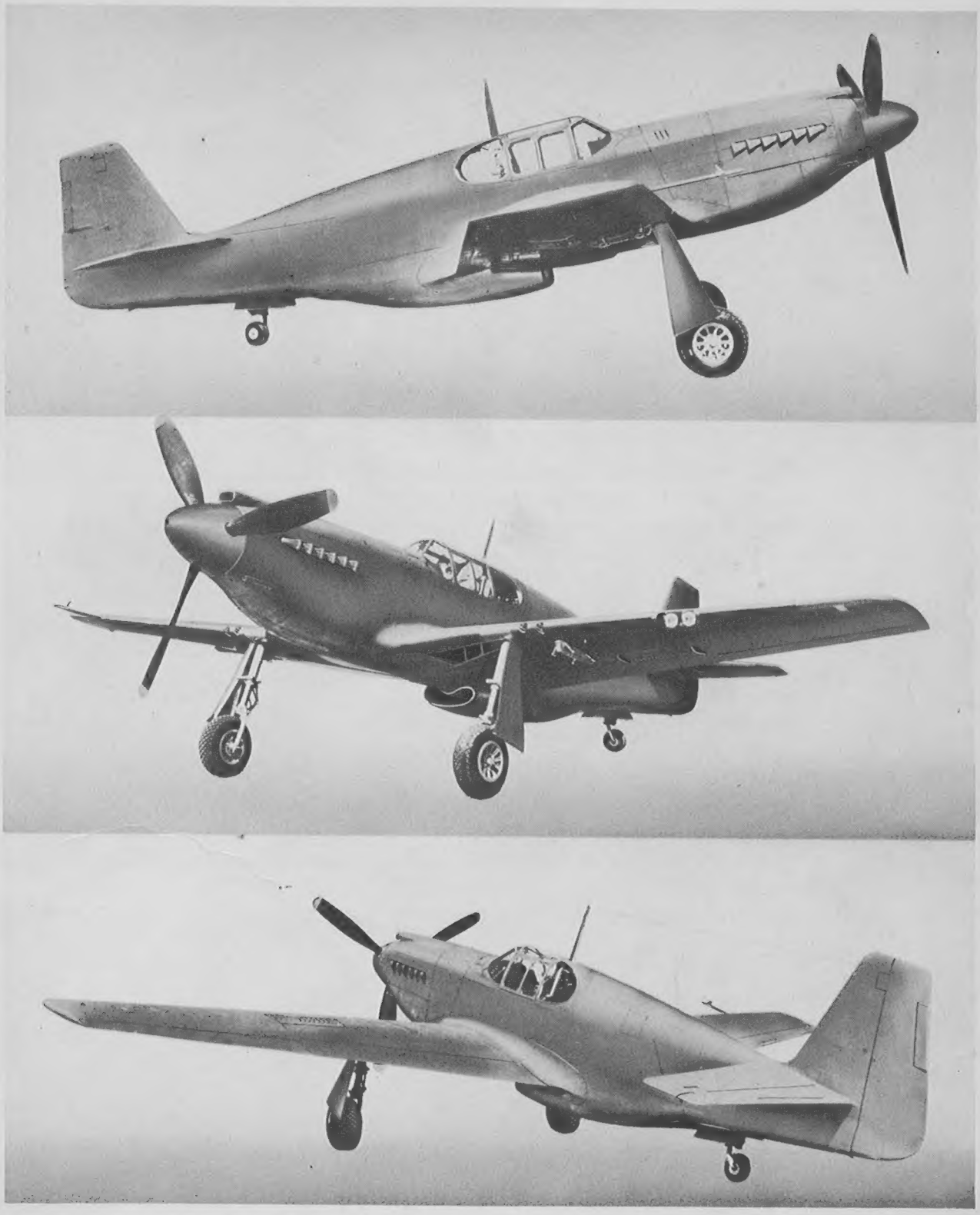


Figure 1 - Model A-36A-1-NA (Complete Airplane)

SECTION I

DESCRIPTION

1. GENERAL.

The model A-36A-1-NA is a fighter-divebomber, single-seat airplane. It is powered with a 12-cylinder Allison engine, model V-1710-87. It has a Curtiss, constant-speed, three-blade propeller with a reduction gear ratio of 2:1. The airplane has a wing span of 37 feet 5/16 inches and an over-all length of 32 feet 2-5/16 inches. Its over-all height, with the tail down, is 12 feet 8 inches.

2. FUSELAGE.

a. GENERAL. - The fuselage is a semimonocoque, aluminum-alloy structure. It is divided into three sections: engine mount, main fuselage, and aft section. An overturn structure is located aft of the pilot's seat. Armor plate is provided as the fire wall, and provision is made, as overload, for armor plate behind the pilot's seat.

b. COCKPIT ENCLOSURE. - Armor plate glass is integral with the forward panel of the windshield. The cockpit is covered with a flush-type transparent hood. The left side of the hood hinges out and down, and the right side hinges up and out. Both sides have sliding windows. An emergency exit lever is located on the right-hand forward side of the cockpit by which the pilot may instantly release the entire hood for emergency egress.

3. WING.

The wing is a semimonocoque, full-cantilever structure and consists of two sections bolted together. The sections employ the low-drag laminar-type airfoil. The ailerons are metal covered. The right aileron is equipped with a booster tab, and the left aileron is equipped with a combination booster and trim tab, the latter controllable from the cockpit. Hydraulically operated wing flaps, sealed-type, extend from the ailerons to the fuselage. The airplane is equipped with four dive brakes, controlled from the cockpit. Two are on the upper surfaces of the wings and two on the lower. They are of the perforated-flap type and, when closed, form a portion of the wing contour.

4. LANDING GEAR.

The landing gear consists of two main oleo struts and a steerable tail wheel. All three units are fully retractable hydraulically. The wheels of the main oleo struts are fitted with hydraulic brakes.

5. HYDRAULIC SYSTEM.

The hydraulic system is utilized for the operation of the landing gear, tail gear, radiator air scoop, wing flaps, and dive brakes. A hydraulic accumulator is provided in the system so that pressure may be obtained instantaneously for the operation of the various systems.

6. FUEL SYSTEM.

A fuel tank with a capacity of 90 U.S. gallons (75 Imperial gallons) is located in each wing. The reserve fuel supply is incorporated within the left tank. Additional auxiliary tanks may be attached to the bomb racks under each wing. (Refer to section IV.) A manually controlled electrical booster pump is provided in addition to the engine-driven fuel pump.

7. OIL SYSTEM.

The oil tank is located on the forward side of the fire wall and is so designed as to allow the airplane to assume any attitude when the tank is full, and feed adequately in a vertical climb or dive when the tank is only one-fourth full.

8. COOLING SYSTEM.

The coolant tank is located on the inside top of the engine nose ring and protected with armor plate between the tank and the propeller spinner. The oil-coolant radiator is located at the bottom of the fuselage, aft of the cockpit, and between the forward and aft air scoops. The radiator is cylindrical in shape and is divided into two concentric radiators, the outer for the coolant and the inner for oil. An automatic relief valve is provided to permit the oil at excessive pressure, which results when the oil is cold, to bypass the oil radiator. The rear radiator air scoop is hydraulically operated and may be adjusted by the control handle located at the aft end of the control pedestal to the left of the pilot's seat. The front radiator air scoop is not adjustable.

9. GUNNERY EQUIPMENT.

Two .50-caliber Browning machine guns are rigidly mounted in the engine compartment, and there are two .50-caliber machine guns mounted on each wing panel, making a total of six guns. Normal ammunition allotment is 200 rounds for each gun. Provision is made for a gun camera beneath the forward end of the engine. An optical gun sight and an auxiliary ring and bead sight are provided.

10. BOMBING EQUIPMENT.

A removable, streamline bomb rack is installed on each outer wing panel. Each rack will accommodate one 250-, 300-, or 500-pound demolition bomb.

11. OXYGEN SYSTEM.

A low-pressure oxygen system is provided, with the regulator located on the right-hand side of the instrument panel. The oxygen cylinders may be recharged without removing them from the airplane.

12. RADIO.

Either of two radio sets, the SCR-274 or the SCR-522, is installed in the radio compartment immediately behind the overturn structure.

13. LIGHTS.

Conventional navigation lights are provided on the upper and lower surfaces of the wing tips and at the trailing edge of the rudder. Two landing lights are located in the leading edge of the left wing section. An identification light is situated aft of the aerial mast on top of the fuselage. Three recognition lights of red, green, and amber are installed in the bottom of the forward scoop and may be operated separately. The instrument panel is illuminated by fluorescent lights. The cockpit is illuminated by Grimes lights. The controls for all lighting are mounted on their respective switch panels in the cockpit.

14. ANTI-ICING SYSTEMS.

a. CARBURETOR.

(1) On airplanes, serial Nos. 42-83663 to 42-83857 inclusive, the carburetor anti-icer system consists of a reservoir located aft and below the pilot's seat, and a hand pump located to the left of the pilot's seat.

(2) On airplanes, serial Nos. 42-83804 and subsequent, the carburetor anti-icer system consists of a temporary tank located in the right-hand wing ammunition box, and an electric pump operated by an off and on circuit breaker switch located on the left-hand side of the cockpit.

b. WINDSHIELD. - A spray jet provides fluid for the windshield from the coolant system and is controlled by a valve located on the upper right side of the instrument panel.

15. HEATING AND VENTILATING.

Wooden bulkheads are provided aft of the cockpit to aid in the heating of the cockpit and to keep drafts at a minimum. A hot-air valve is located to the right and aft of the pilot's seat; a cold air valve is located to the left of the control stick. A windshield defroster is provided and is controlled by the handle at the top left side of the instrument panel.

16. MISCELLANEOUS EQUIPMENT.

a. PYROTECHNICS. - An automatic signal recognition device is located aft of the radio compartment, with a control on the right side of the pilot. The control has a selector control so that flares of any desired color may be put into firing position.

b. PILOT'S SEAT. - The pilot's seat is made of plywood and will accommodate a seat-type parachute. The back cushion is kapok filled to make it buoyant and it may therefore be used as a life preserver. The seat is equipped with a type B-11 safety belt and a type 41G8725 shoulder harness attached to a spring-loaded mechanism. The control lever for the shoulder harness is on the forward left side of the seat, and the vertical adjustment lever for the seat is located on the forward right side.

c. PILOT'S RELIEF TUBE. - The relief tube horn is stowed on a bracket at the left under side of the pilot's seat. The tubing extends along the lower inboard side of the fuselage to where it emerges through an aluminum scoop outlet beneath the rudder.

d. FIRST-AID KIT. - A medical first-aid kit is attached to a bracket on the left fuselage side panel in the radio compartment.

e. WATER CONTAINERS. - A water container and an emergency water bottle are stowed in the aft end of the radio compartment.

f. RATIONS. - One kit of ordinary rations and one kit of emergency rations are stowed in the aft end of the radio compartment.

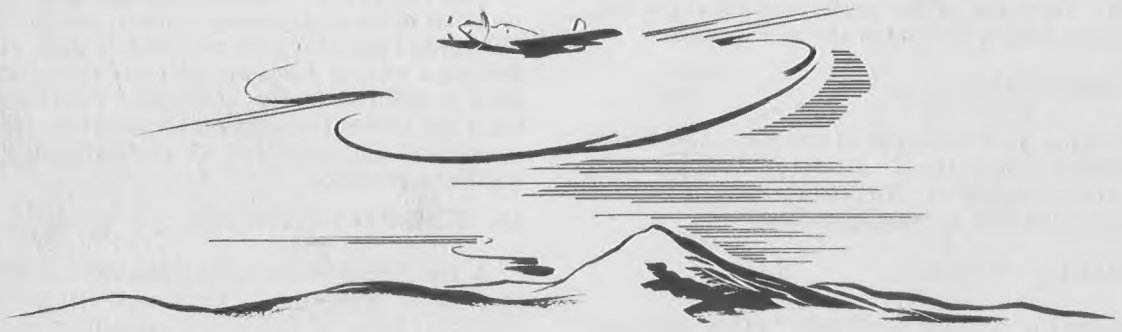


Figure 2 - Cockpit (Front View)

NOMENCLATURE

Figures 3 and 4

13. Throttle
21. Enclosure Emergency Release Handle
22. Propeller Constant-Speed Control
23. Landing Gear Emergency Down Control
31. Carburetor Air Temperature Control
34. Automatic Flare Discharger Control
47. Instrument Static Selector Valve
48. Bomb Control Handle
54. Landing Gear Control Handle
60. Hydraulic Hand Pump
61. Recognition Light Keying Switch
62. Sliding Window Control
63. Spare Lamp Compartment
64. Pitot Heater Switch
65. White Recognition Light Switch
66. Red Recognition Light Switch
67. Green Recognition Light Switch
68. Amber Recognition Light Switch
69. Wing Navigation Light Switch
70. Tail Navigation Light Switch
71. RH Fluorescent Light Control
72. Landing Light Switch
73. Generator Disconnect Switch
74. Ammeter
75. Transmitter Key
76. Earphone Jack
77. Microphone Jack
78. Cockpit Light
79. Transmitter Light Selector Switch
80. Transmitter Power Toggle Switch
81. Transmitter Selector Switch
82. Jack Selector Switch - 3-6 MC
83. Receiver Signal Selector Switch - 3-6 MC
84. Jack Selector Switch - 190-550 KC
85. Receiver Signal Selector Switch - 190-550 KC
86. Jack Selector Switch - 6-9.1 MC
87. Receiver Signal Selector Switch - 6-9.1 MC
88. Receiver Volume Control - 3-6 MC
89. Receiver Frequency Control - 3-6 MC
90. Receiver Volume Control - 190-550 KC
91. Receiver Frequency Control - 190-550 KC
92. Receiver Volume Control - 6-9.1 MC
93. Receiver Frequency Control - 6-9.1 MC
94. Filter Switch Control
95. Right Fuel Tank Gage
96. Microphone Press-To-Talk Switch
97. Mixture Control
98. Cockpit Light
99. Dive-Brake Control
100. Quadrant Friction Control
101. Flap Position Indicator
102. Radiator Air Scoop Position Indicator
103. Flap Control Handle
104. Radiator Air Scoop Control Handle
105. Rudder Trim Tab Control
106. Aileron Trim Tab Control
107. Landing Gear Mechanical Position Indicator
108. Bomb Control Antisalvo Guard
109. Tail Wheel Lock Control
110. Elevator Trim Tab Control

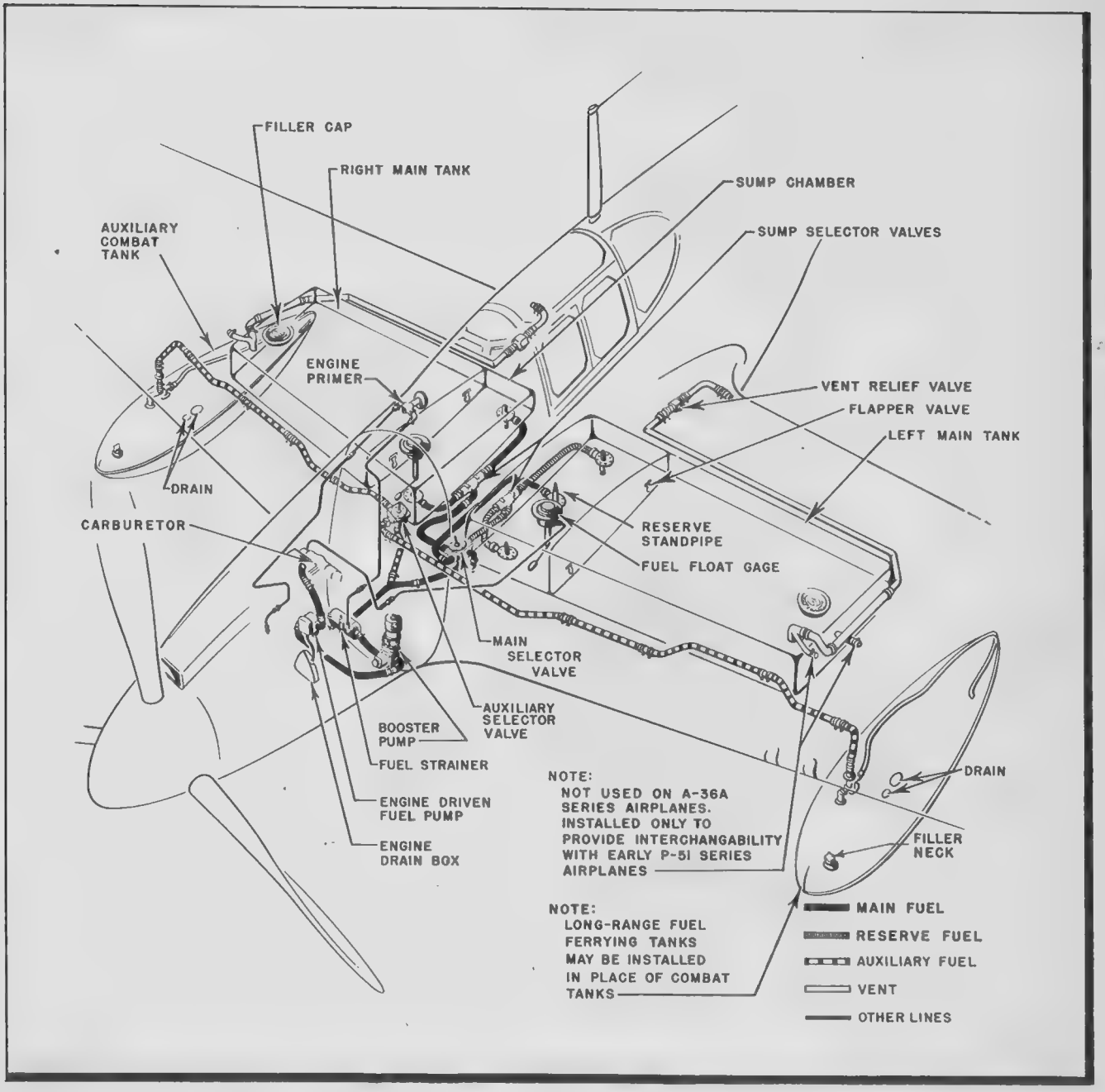


Figure 5 - Fuel System Diagram

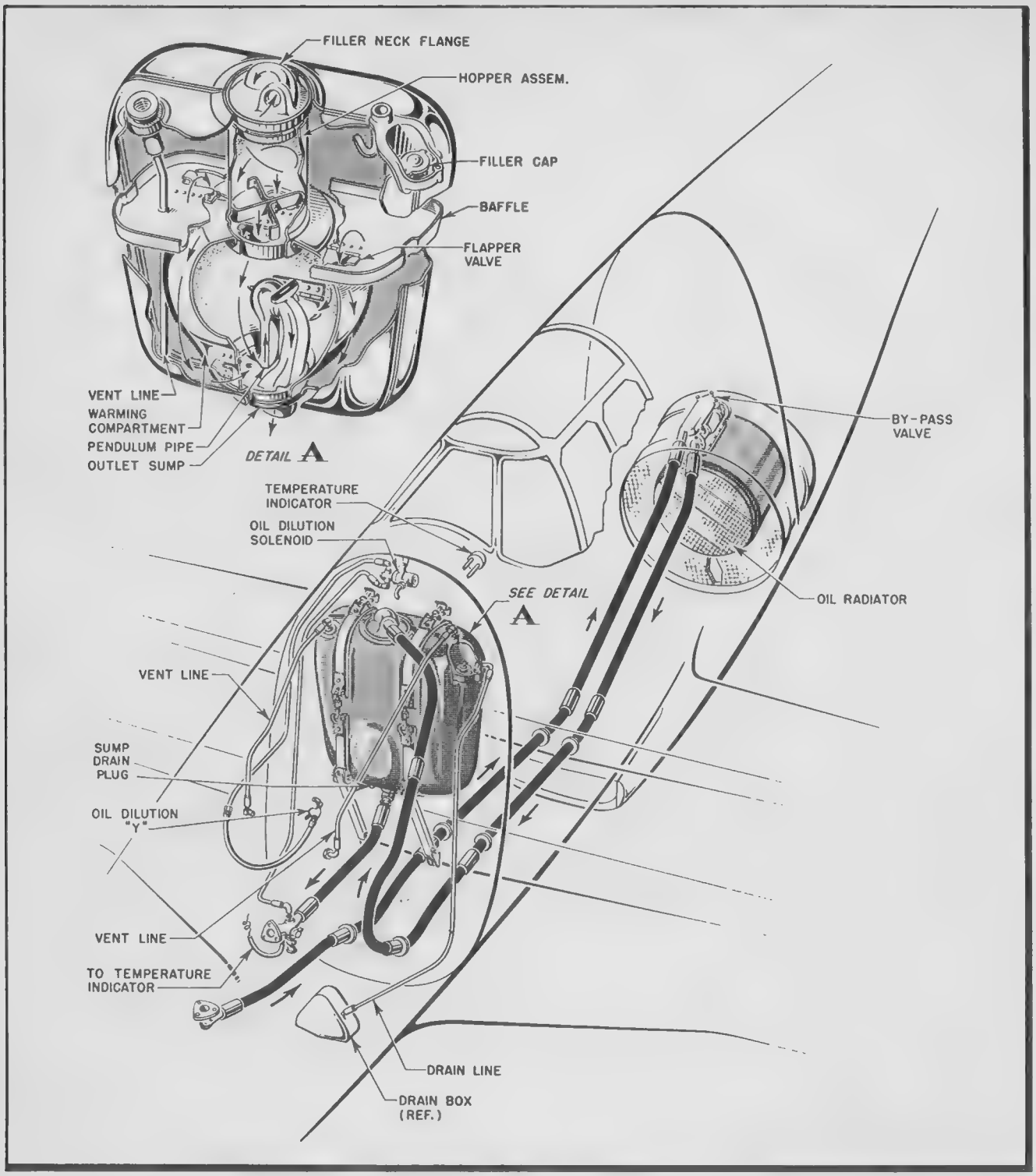


Figure 6 - Oil System Diagram

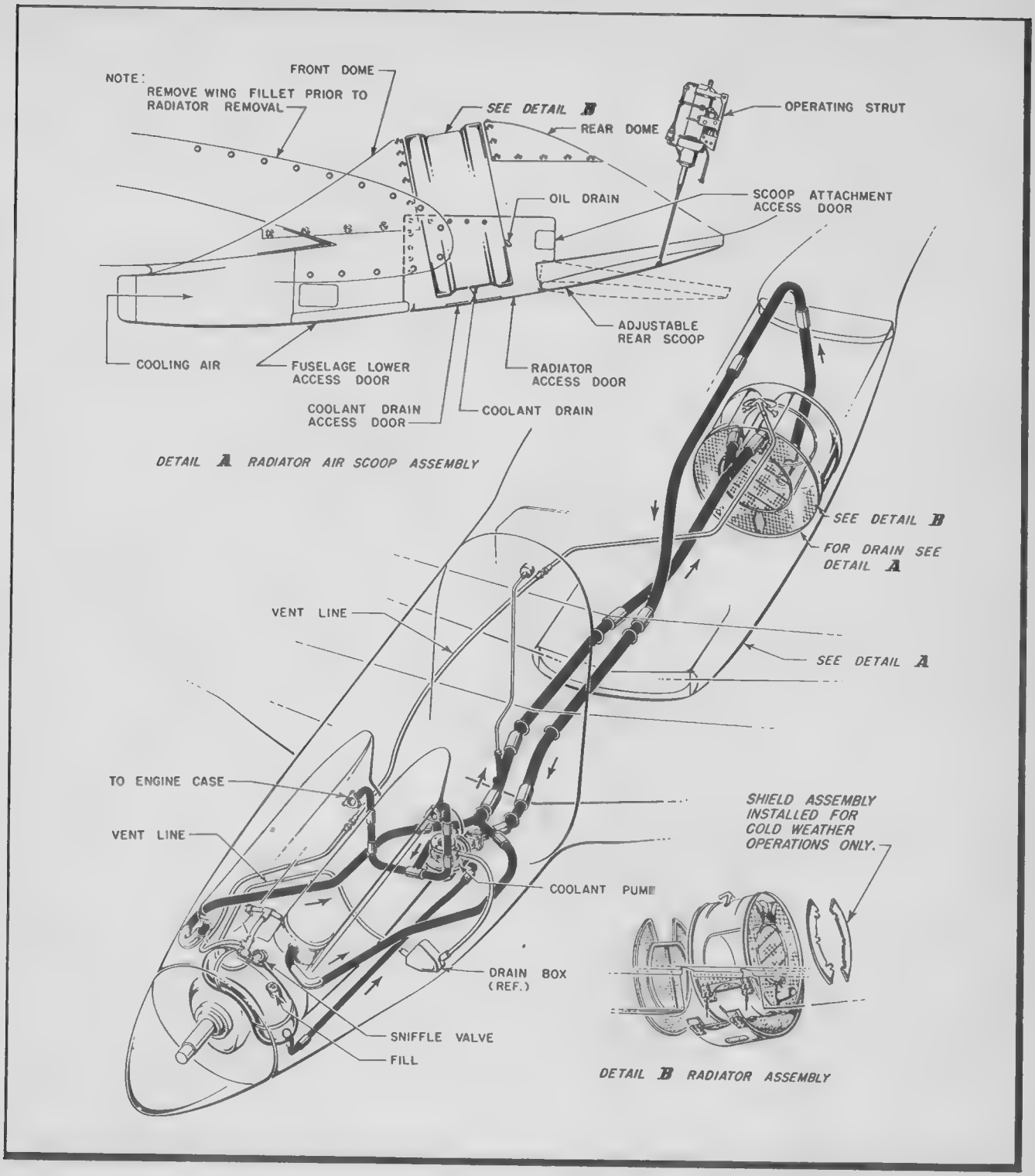


Figure 7 - Cooling System Diagram

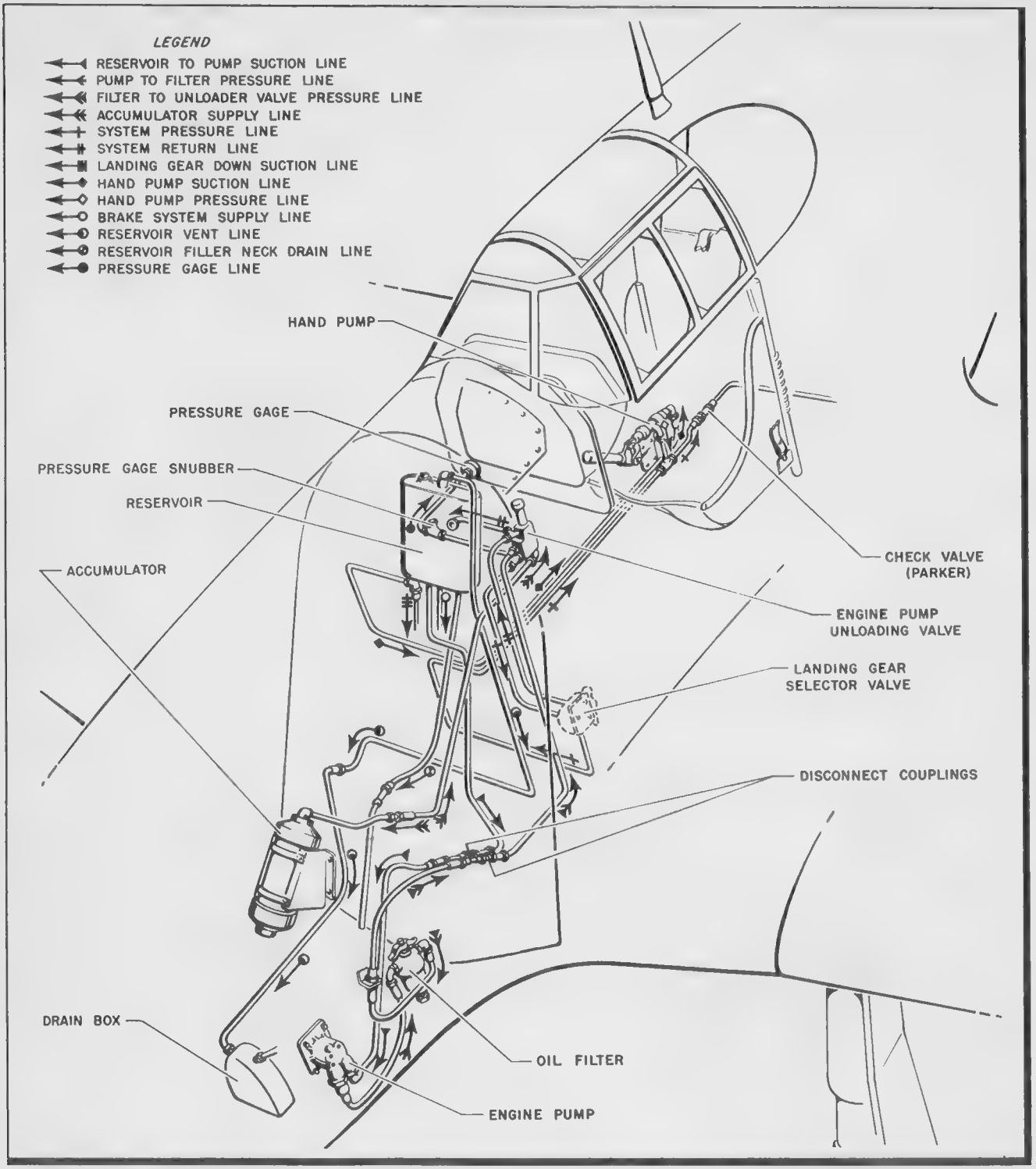


Figure 8 - Hydraulic System Diagram (power system)

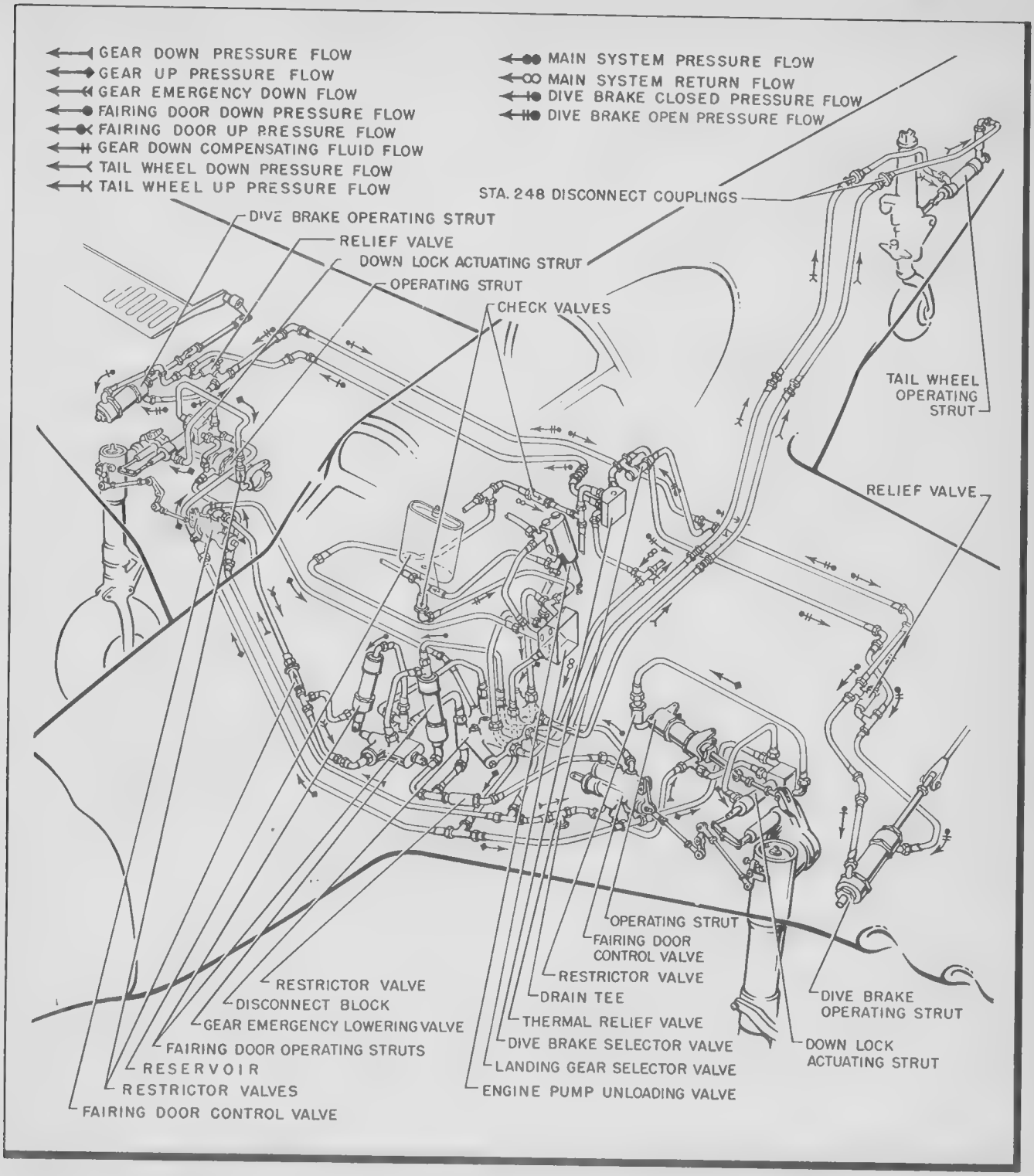


Figure 9 - Hydraulic System Diagram
(landing gear and dive brakes)

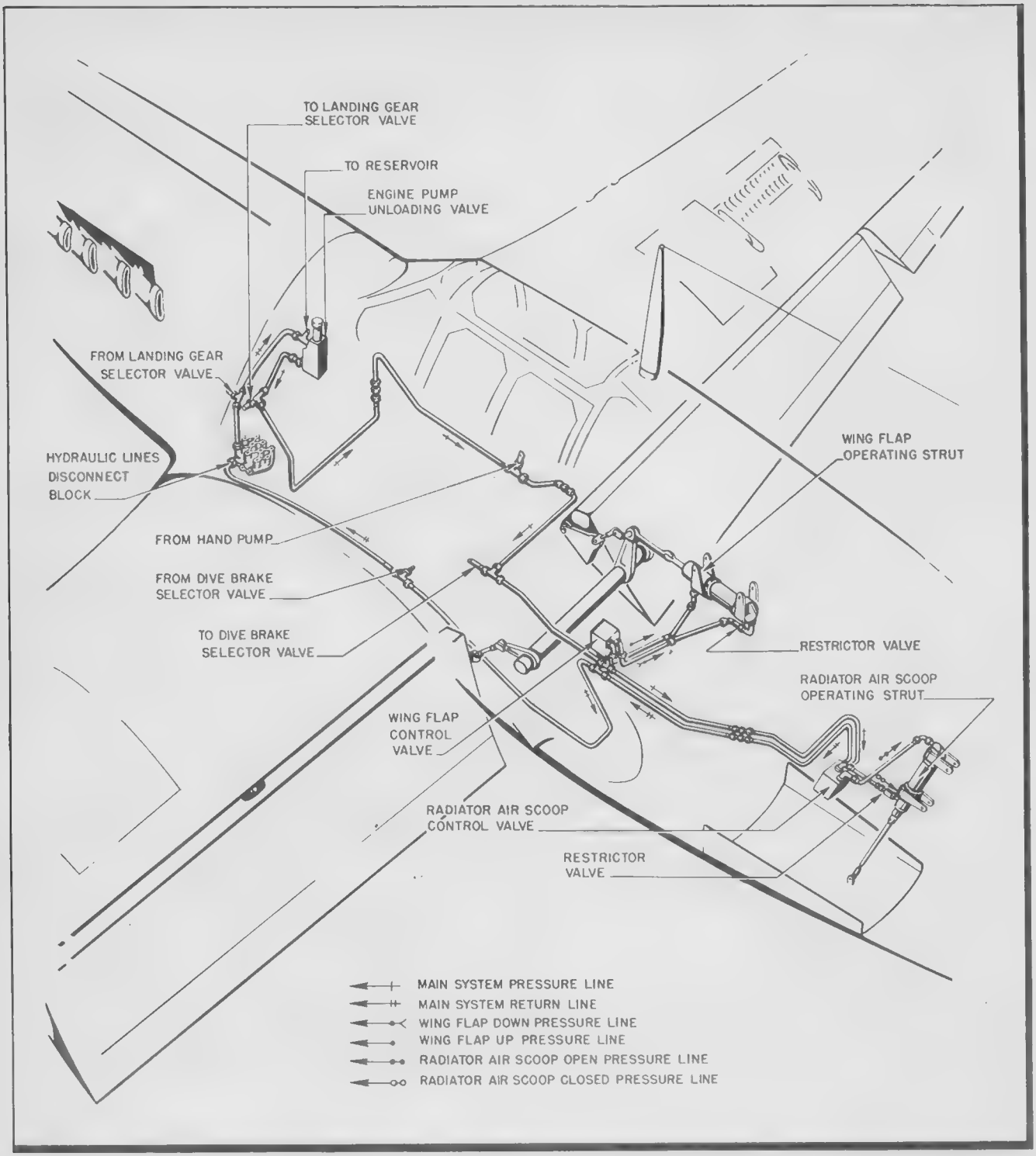


Figure 10 - Hydraulic System Diagram (radiator air scoop and wing flaps)

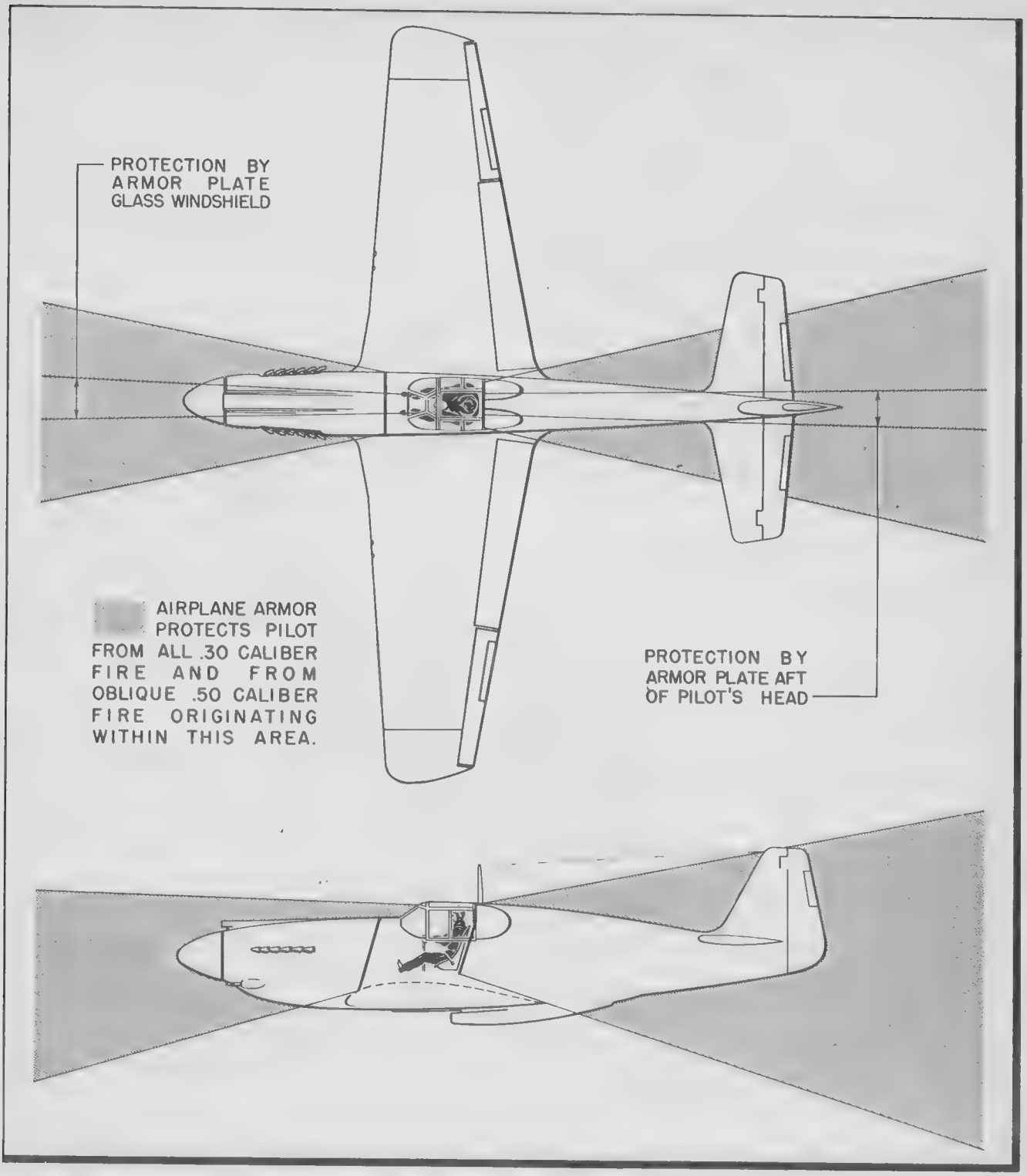


Figure 11 - Angles of Armor Protection Diagram

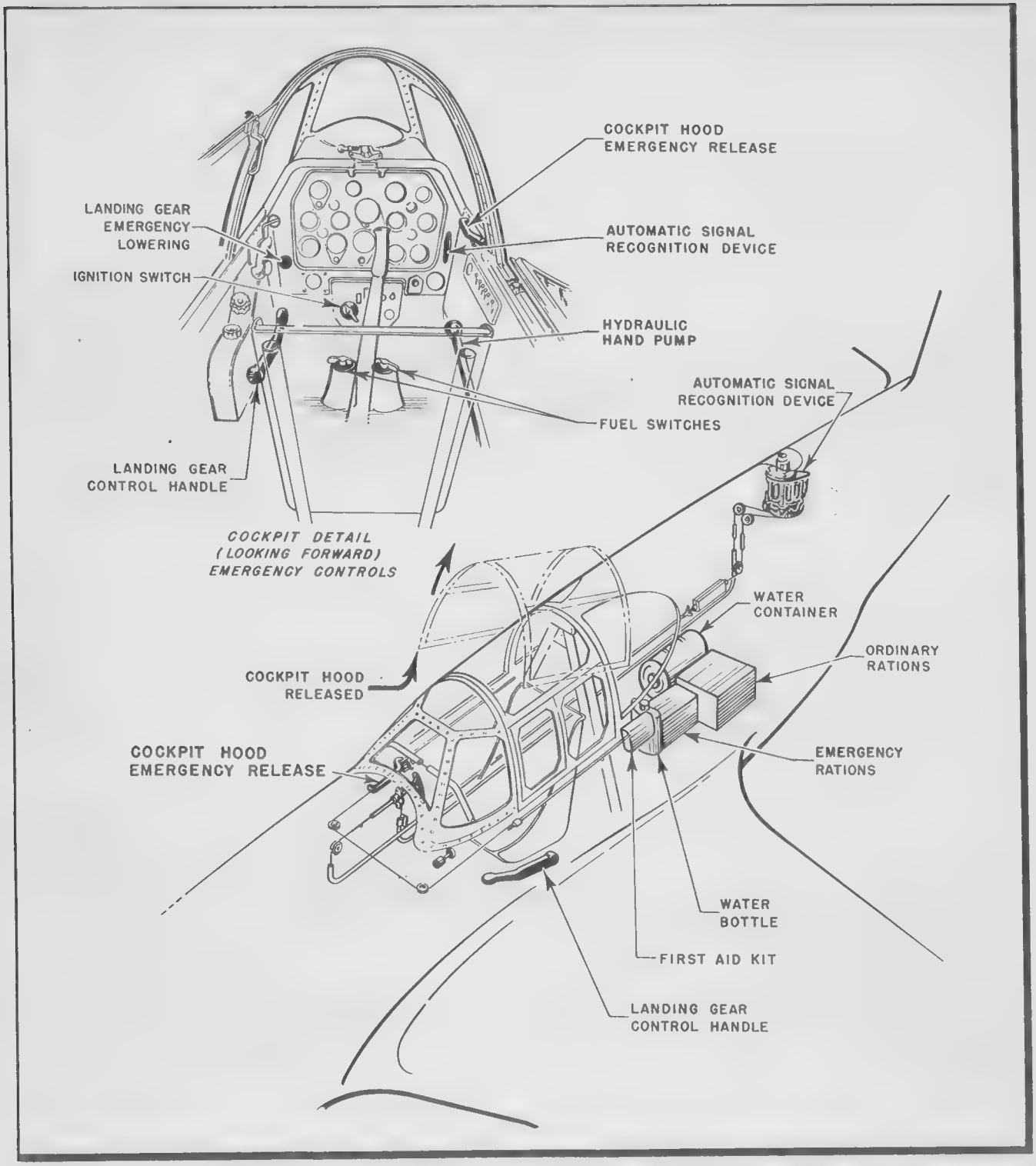


Figure 12 - Emergency Equipment and Exits Diagram

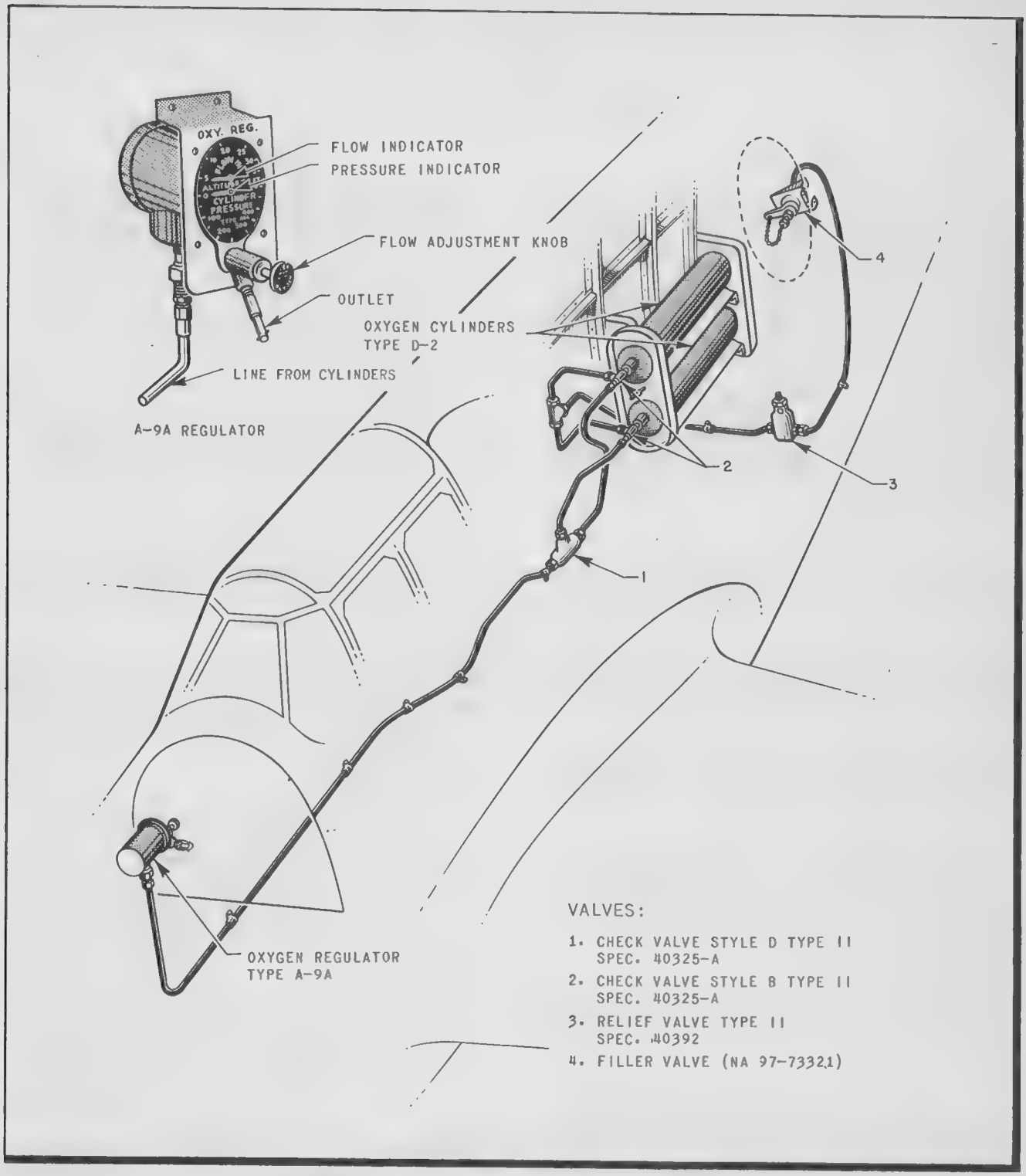


Figure 13 - Breathing Oxygen System Diagram

SECTION II

PILOT'S OPERATING INSTRUCTIONS

1. BEFORE ENTERING COCKPIT.

a. Ascertain that the total weight and disposition of the load are strictly in accordance with the Weight and Balance Chart, section III. The center of gravity position should be determined by means of the data furnished, and the loading so adjusted as to bring the center of gravity within the range designated. If the fuselage guns should be removed, ballast need not be installed to compensate for them, as the airplane tends to be nose heavy with fuselage guns installed.

b. Make sure that the airplane has been serviced and is ready for flight, especially in regard to fuel and oil. See that there is nothing in the cockpit which might foul the controls or otherwise affect the operation of the airplane, such as the seat belt, safety harness, microphone cords, etc.

2. ON ENTERING COCKPIT.

a. Unlock the surface control lock at the base of the control stick by pulling the locking plunger to the left and allowing the stick assembly to ride free. Check the movement of all flying controls.

b. Adjust the rudder pedals for proper leg length so as to obtain full brake control while taxying. Adjustment may be made with the foot by pressing the lever located on the inner side of each rudder pedal.

c. Adjust the seat level to obtain full travel of the rudder pedals in the extreme positions. The adjustment lever for raising and lowering the seats is located on the lower right side of each seat.

d. Apply the parking brakes preparatory to running up the engine. Application is made by pressing both brake pedals to their full extent, pulling out on the control knob located on the subpanel below the front instrument panel, releasing the brake pedals, and then releasing the control knob, in that order. If chocks are available, use them also.

e. Check the fuel contents as indicated on the two fuel gages, which are located on the floor at each side of the seat. The gages are accurate in level flight position only.

f. Pull up on the handle of the emergency hand pump, located on the right side of the cockpit, and rotate the handle clockwise into its locked position. Move the flap control handle, which is located on the control pedestal, to its down position, and operate the hand pump until the flaps are fully lowered, as shown by the mechanical flap position indicator located forward of the control pedestal at the left side fo the cockpit. Reverse the operation and return the pump handle to its proper position.

WARNING

Do not move the landing gear control handle, located on the control pedestal to the left of the seat, while the airplane is on the ground.

g. Turn on the generator main line switch and turn the ignition switch to "BAT."

h. Switch on the pitot head heater if flying is to be done under icing conditions.

i. Set the altimeter.

j. Check the two pins in the right sliding window track to see that they do not protrude above the level of the track. Pins that extend into the track indicate that the enclosure is released.

k. Close the cockpit sliding windows and keep them closed except in case of poor visibility.

l. Check the radio system to see that it is working properly. Instructions for operating the radio system will be found in section IV.

m. If bombs, combat fuel tanks, or ferrying fuel tanks are installed beneath the wing, ascertain that the bomb control handle is in the "LOCK" position, the antisalvo guard is in place, and the bomb safety switch is "OFF."

3. STARTING ENGINE.

a. Turn the ignition switch to the "OFF" position.

b. Pull the propeller through several turns if it has been idle for more than two hours.

c. Place the carburetor air heat control at the position marked "COLD" so as to limit the danger in case of backfire.

d. Close the radiator air scoop. The control handle is located at the aft end of the control pedestal.

e. Set the propeller control located beside the throttle to the "INCREASE RPM" (low pitch) position.

f. Set the mixture control at the "IDLE CUT-OFF" position.

g. Set the throttle approximately 3/4 inch open.

h. Turn the main system fuel selector valve to "RESERVE." The auxiliary system selector valve should be in the "OFF" position.

i. Prime the engine three to four strokes when cold, one stroke when warm. The priming system is independent of the carburetor, and caution must be exercised not to overprime the engine in view of the extreme effectiveness of the priming system. However, ascertain that the primer is properly loaded to obtain enough prime. No priming action nor fuel discharge is accomplished by pumping the throttle. After priming, ascertain that the primer is locked in the "OFF" position.

j. See that all personnel are clear of the propeller; then turn the ignition switch to "BOTH."

k. Set the propeller selector switch in the "AUTO CONSTANT SPEED" position and push the propeller circuit breaker button to ascertain that the electrical circuit to the propeller governor is complete. Raise the safety guard over the selector switch. Both propeller controls are located on the pilot's switch panel.

l. Set the fuel booster pump switch, located on the pilot's switch panel, to the "ON" position. The fuel pressure gage should indicate 10 pounds per square inch shortly after the booster pump is turned on.

m. Uncover the starter switch by pulling the hinge cover upward. Press the starter switch to the "ENERGIZE" position; and when the flywheel has reached maximum speed, press the switch upward to the "CRANK" position to engage the starter with the engine. Provision for connecting an external electrical supply is made by means of a plug connector located on the right side of the fuselage, aft of the pilot's cockpit. Provisions are also made for hand-starting the engine by means of starter crank and extension stowed in the right wheel well. The starting crank may be removed by loosening the wing nut on the clamp around the arm of the crank. The extension tube is removed by twisting up and pulling outward. To start the engine by means of the crank, insert the crank and extension through the hole in the lower aft engine cowl into the funnel-shaped starter attachment.

n. As the engine starts, move the mixture control to the "AUTO RICH" position. If the engine does not start after one or two turns, move the mixture control out of and then back to the "IDLE CUT-OFF" position.

4. ENGINE WARM-UP.

Warm up the engine at 1000 to 1200 rpm until the oil temperature shows a definite increase and the oil pressure remains steady when the throttle is opened. If the oil pressure does not reach 60 pounds per square inch within 30 seconds, stop the engine and investigate. The desired coolant and oil temperatures may be obtained by operating the radiator air scoop exit flap. The control for the exit flap is located on the control pedestal at the left side of the seat. The exit flap is hydraulically operated by merely moving the radiator air control to the desired position. A position indicator for the exit flap is provided on the panel at the left side of the cockpit just forward of the engine control quadrant.

5. TESTING.

a. Check the instruments for the following engine limitations:

	Desired	Maximum
Oil Pressure	60-70 lb/sq in.	85 lb/sq in.
Oil Temp	60°-80°C (140°-176°F)	95°C (203°F)
Coolant Temp	105°-115°C (221°-239°F)	125°C (257°F)
Fuel Pressure	12-16 lb/sq in.	16 lb/sq in.

b. Press the propeller selector switch to the "MANUAL" position and raise the engine to 2200 rpm at 30 inches Hg manifold pressure. Check each magneto for a maximum loss of 80 rpm by means of the ignition switch. This check should be made in as short a time as possible.

c. Press the propeller selector switch back to the "AUTO CONSTANT SPEED" position and move the propeller governor control to see that there is a change in rpm. Then move the control forward to the full "INCREASE RPM" position.

d. While the engine is warming, test the operation of the flaps with the engine-driven hydraulic pump. Check the hydraulic pressure gage for a pressure indication of 1000 pounds per square inch.

WARNING

Do not move the landing gear control handle, located on the control pedestal to the left of the seat, while the airplane is on the ground.

e. Ascertain that the artificial horizon is caged and that the engine-driven suction pump is producing between 3.75 and 4.25 inches Hg vacuum pressure. Line up the adjustable airplane silhouette with the center of the caged horizon.

f. Recheck the signal-to-noise ratio of the radio receiver with the engine running, in accordance with instructions contained in section IV.

g. Having observed that the oil pressure does not exceed 85 pounds per square inch, decrease the engine revolutions gradually to 2000 rpm, and confirm the following:

(1) That the ammeter registers no more than 100 amperes.

(2) That the suction pump registers no more than 4.25 inches Hg.

(3) That the fuel pressure gage registers no more than 16 pounds per square inch, no less than 12 pounds per square inch.

(4) That each position of the fuel selector valve functions properly.

h. Be sure that the cockpit hood is locked and emergency safetied.

i. Check the operation of all surface controls.

j. Set the rudder trim 5 degrees to the right. Set the elevator trim 3 degrees back.

6. TAXYING.

a. Adjust the radiator air scoop exit flap to obtain the desired oil and coolant temperatures.

b. Unlock the tail wheel by means of the control on the aft end of the pedestal at the left of the seat.

c. For ordinary taxying, the following generalities should be observed:

(1) Use the brakes as little as possible and always taxi cautiously.

(2) Steer a zigzag course to survey the area obstructed by the engine.

(3) On reaching the take-off position, stop the airplane cross-wind so that approaching airplanes can be plainly seen.

7. TAKE-OFF.

When the field is clear, quickly check the following:

a. See that the fuel booster pump is turned on.

b. See that the mixture control is in the "AUTO RICH" position.

c. See that the propeller control is fully forward in the "INCREASE RPM" (low pitch) position, and the propeller selector switch is in the "AUTO CONSTANT SPEED" position.

d. Now, depress the propeller circuit breaker button.

e. Ascertain that the main system fuel selector valve is in the "RESERVE" position and the auxiliary system fuel selector valve is in the "OFF" position.

f. See that the generator disconnect switch is turned to "ON."

g. Open the radiator air scoop as required.

h. Check for:

Minimum Oil Temperature	20°C (68°F)
Maximum Oil Pressure	85 lb/sq in.
Minimum Coolant Temperature	85°C (185°F)

i. Turn into the wind and lock the tail wheel.

j. If high obstacles are to be cleared and only a short run is available, set flaps at 20 degrees down. Take-off position, or 20-degree down position, is marked beside the flap control handle and is selected and locked by moving the flap control to desired position. Observe the flap movement on the flap position indicator.

k. Open the throttle to 47 inches Hg manifold pressure and take off at 3000 rpm. Full throttle may be used for emergency.

l. Do not attempt to lift the tail too soon as it increases the torque action.

8. ENGINE FAILURE DURING TAKE-OFF.

If the engine fails immediately after the take-off, act quickly as follows:

a. Maintain speed by depressing the nose at once so that the air speed does not drop below 110 mph indicated.

b. Release the cockpit enclosure by pulling the emergency release located on top of the longeron just to the right of the instrument panel.

c. Make sure that the landing gear has started to come up. There is no time to take further action; and even if it is only unlocked and on the way up, the gear will collapse on landing. Do not try to lower it. There is less likelihood of personal injury if the airplane is landed with the landing gear up.

d. Lower the flaps fully if possible.

e. Land straight ahead, only changing direction sufficiently to miss obstructions.

f. If there is time, switch off the engine to reduce the risk of fire. In any case, do it after landing, and turn the fuel selector valves to "OFF."

g. After landing, get out of the airplane as quickly as possible and remain outside.

9. CLEARING THE FIELD.

a. As soon as the airplane is sufficiently clear of the ground, retract the landing gear by pulling the landing gear control handle inboard and up. The handle is located on the control pedestal to the left and just forward of the seat. Observe the landing gear position from the mechanical indicator located on the top forward end of the control pedestal.

b. If the flaps have been partly lowered for the take-off, raise them provided that indicated air speed is at least 110 mph and all obstacles sufficiently cleared. Raising the flaps is accomplished by pulling the flap control to the fully up position. No sink is noticeable when the flaps are raised.

c. Climb at 160 mph indicated and check the glycol and oil temperature together with the oil pressure.

d. Turn the fuel selector valve from "RESERVE" to the desired tank.

WARNING

Ascertain that the selector valve for the fuel system not being used is in the "OFF" position. The engine will not run if either selector valve is set on an empty tank.

10. CLIMBING.

Due to variations in external loads and altitude at which the airplane is to be flown, climb data should be obtained from Take-off, Climb and Landing Charts located in section III.

11. CRUISING.

a. Consult the Cruising Charts in section III and check for the following desired instrument readings:

Coolant Temperature	105° - 115°C (221° - 239°F)
Oil Temperature	60° - 80°C (140° - 176°F)
Oil Pressure	60-70 lb/sq in. (Minm 55 lb/sq in.)
Fuel Pressure	12-16 lb/sq in.

b. If auxiliary fuel tanks are installed, use the fuel from them first and shift from the left tank to the right tank as desired to prevent excessive wing heaviness. When the main fuel system is in operation, use the fuel from the left and right fuel tanks alternately and then the reserve supply in the left main tank. Ascertain that one selector valve control is off when the other is in use.

12. GENERAL FLYING CHARACTERISTICS.

a. Wing flaps must not be fully lowered when the airplane is being flown in excess of 165 mph IAS.

b. Landing gear must not be lowered when the airplane is being flown in excess of 170 mph IAS.

c. The effect of flap and landing gear operation on the trim of the airplane in flight is as follows:

(1) Landing gear retracted, airplane becomes tail heavy.

(2) Landing gear extended, airplane becomes nose heavy.

(3) Flaps lowered, airplane becomes nose heavy.

(4) Flaps raised, airplane becomes tail heavy.

(5) Flaps raised at 110 mph IAS, no apparent sink.

d. The following flap setting air-speed restrictions must be observed:

(1) With wing flap setting at 10 degrees do not exceed 400 mph IAS.

(2) With wing flap setting at 20 degrees do not exceed 275 mph IAS.

(3) With wing flap setting at 30 degrees do not exceed 225 mph IAS.

(4) With wing flap setting at 40 degrees do not exceed 180 mph IAS.

(5) With wing flap setting at 50 degrees do not exceed 165 mph IAS.

e. The tab controls are sensitive and must be used with care.

f. Care must be taken while sideslipping that the air speed does not fall below 110 mph; however, a sustained sideslip cannot be performed in this airplane. Recovery from a sideslip should be effected above 200 feet.

13. STALLS.

Though the stall most commonly occurs at low speed, it should be remembered that it may occur at any speed if the control stick is brought back far enough to put the airplane at stalling incidence. The following is a brief description of the stalling characteristics of this airplane:

a. With flaps and landing gear up, the stalling incidence is reached at about 85 mph indicated, when a wing will drop. If the wing drops and backward movement on the stick continues, the airplane will fall into a steep spiral.

b. With the flaps and landing gear down, the stalling incidence is reached at about 80 mph indicated. As speed is reduced, a wing will drop rather slowly; and unless recovery is effected immediately, the airplane will fall into a steep spiral. An indicated speed of 165 mph should not be exceeded with the flaps fully down.

c. The stall in this airplane is comparatively mild in that it does not whip at the stall but rolls rather slowly and has very little tendency to drop into a spin. If the stick and rudder are released at the stall, the nose drops sharply and it recovers from the stall almost instantly. In a straight power-off stall, some warning is given about 3 to 4 mph above the stall by slight elevator buffet. A high-speed stall is preceded by sharp buffeting at the elevators and wing root, but recovers immediately when pressure on the stick is released.

d. Recovery from any stall in this airplane is entirely normal, that is, by the release of back pressure on the stick and the application of rudder opposite from the dropping wing.

14. SPINS.

a. DIFFERENCES. - There is a marked difference between a sustained left and right spin in this airplane. The differences are as follows:

(1) The left spin oscillates from 80 degrees below the horizon back to the horizon during the first turn, dampens out 50 percent during the second turn, and then becomes stable, smooth, and quiet with the nose approximately 30 degrees to 40 degrees below the horizon.

(2) The right spin starts exactly the same as the left spin, but the oscillations continue without increasing or decreasing in magnitude.

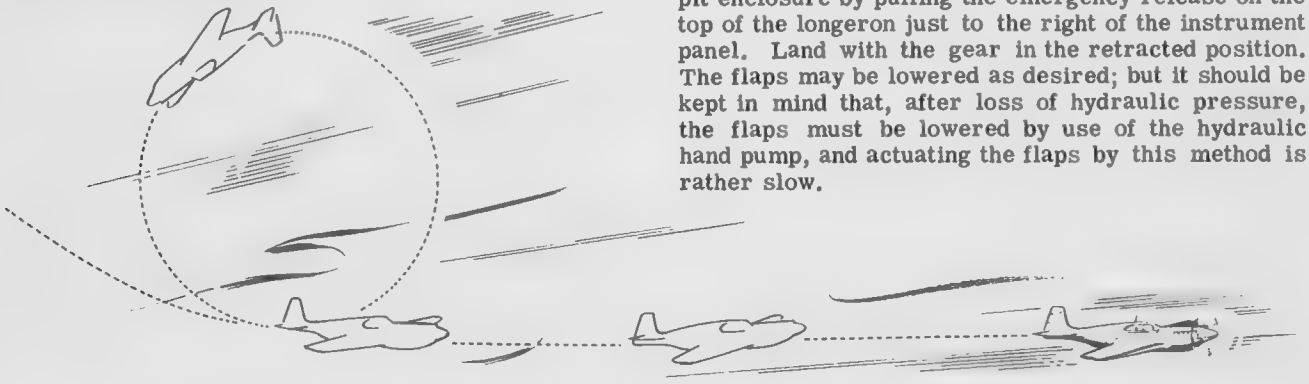
b. RECOVERY. - Recovery is the same in both a left and right spin. Upon application of opposite rudder, the nose drops slightly and the spin speeds up rapidly for one and one-quarter turns, after which the spin stops. Rudder force is light at first, becomes very heavy for a period of about 1 second at the first half turn after starting recovery, then drops to zero as the spin stops. Recovery is effected in the normal manner, that is, full opposite rudder followed by movement of the stick to neutral.

NOTE

Slight rudder buffet occurs during the spin. If recovery from the dive is attempted too soon after stopping the spin, a rather heavy elevator and rudder buffet will occur.

15. ACROBATICS.

The acrobatic qualities of this airplane are exceptional, and the lateral control is excellent at all speeds. All normal acrobatics are permitted. However, inverted flying must be limited to 10 seconds because of loss of oil pressure and failure of the scavenger pump to operate in inverted position.



16. DIVING.

a. The maximum permissible diving speed is 505 mph IAS, during which the engine must not exceed 3120 rpm and 47 inches Hg manifold pressure. During a dive in which high power is used, it is not necessary to pull back the propeller control; however, if diving at reduced throttle, the propeller should be set at 2300 rpm to prevent exceeding 3120 rpm. The use of elevator tabs is not required for dive recovery because of the low elevator control forces.

b. Dive brakes should not be opened when the airplane is being flown in excess of 350 mph IAS. The maximum permissible diving speed with the dive brakes open is 450 mph IAS.

WARNING

The diving speed of this airplane is far in excess of any other dive bomber utilized by the Army Air Forces.

17. GLIDING.

Gliding may be carried out at any safe speed down to the recommended margin of about 25 percent above stalling speed. With the landing gear and flaps up, the glide is fairly flat with the nose very high. Forward visibility in this condition is poor. Lowering either the flaps or landing gear, or both, greatly steepens the gliding angle for a given speed and the rate of descent is much increased. The following speeds are subject to ± 5 mph IAS, depending on loading:

a. Best gliding speed, landing gear and flaps UP, approximately 140 mph IAS.

b. Best gliding speed, landing gear and flaps DOWN, approximately 125 to 135 mph IAS.

c. Engine assisted glide, landing gear and flaps DOWN, 100 to 110 mph IAS.

18. ENGINE FAILURE DURING FLIGHT.

In the case of total engine failure, release the cockpit enclosure by pulling the emergency release on the top of the longeron just to the right of the instrument panel. Land with the gear in the retracted position. The flaps may be lowered as desired; but it should be kept in mind that, after loss of hydraulic pressure, the flaps must be lowered by use of the hydraulic hand pump, and actuating the flaps by this method is rather slow.

19. RAIN OR POOR VISIBILITY.

When flying in conditions of bad visibility, open the sliding panels of the cockpit enclosure. If moisture or frost forms on the windshield, turn on the defroster system by pulling out on the knob marked "DEFROSTER AIR" at the upper left of the instrument panel. If ice forms on the outside of the windshield, use the de-icer system by holding in the knob marked "WINDSHIELD DE-ICER SPRAY" on the upper right of the instrument panel. Since the de-icer uses glycol from the engine coolant system, it should be used sparingly. In rain or icing conditions, the carburetor heat should be used by pulling out and locking the control marked "CARBURETOR AIR" on the upper left of the instrument panel. Flying speed should be reduced during poor visibility by retarding power and rpm and by partly lowering the flaps.

20. NIGHT FLYING.

For flying this type of airplane at night, the sequences outlined for daylight operation should be even more strictly observed. In addition, the following instructions should be followed before the take-off:

a. Switch on the two cockpit lights located on each side of the cockpit by rotating the rheostat on pilot's switch panel. This rheostat turns the lights on and increases the intensity.

b. Turn on the ultraviolet fluorescent spotlights above the instrument panel by means of the rheostat knobs located on the pilot's switch panel and on the right-hand switch panel. The fluorescent lights are mounted on toggle joints to permit flexibility of movement. The front section of the lamp housing is rotatable, permitting varying intensity of visible light and also an even beam of ultraviolet.

c. Switch on the landing lights, located in the leading edge of the left wing, and see that they are in working order. The switch for these lights is located on the right-hand switch panel. Do not keep them on for more than a few seconds. Of the fixed focused type, these powerful lights are so arranged that the beams are horizontal when the airplane is in the three-point position.

d. Switch on the running lights. All switches are on the right-hand switch panel. There are two intensities available, "BRIGHT" and "DIM."

e. Switch on the compass and gun sight lights by rotating the separate rheostats providing independent lights on these instruments. These rheostats are located on the pilot's switch panel. Adjustment of the intensity of the lights should be made to give sufficient illumination for night operation. Get used to the position of the various lights by feel, especially the switch for the landing lights.

NOTE

In case of a lamp burning out, spares may be obtained from the small compartment on the right forward side of the cockpit. Spare fuses are mounted in the right-hand switch panel and are of various capacities. Each is held by a fuse clip and is plainly marked as to capacity.

21. EMERGENCY EXIT.

The cockpit enclosure may be released as a unit for emergency exit. The emergency exit control handle is located on the right forward side of the cockpit. To release the hood, pull the handle back all the way. This releases the enclosure hinge cams which force the enclosure up and into the slip stream. If the force of the air does not pull the enclosure from the airplane, apply a straight upward push to the roof of the hood. In the event of a crash landing and the attitude of the airplane is such that it is resting on the nose-over structure, pull back on the emergency release handle and push outward on the left panel.

22. APPROACH.

When the airplane nears the field:

a. Turn the fuel selector valve to "RESERVE."

b. Turn on the fuel booster pump.

c. Set the propeller selector at 2600 rpm with the propeller switch at "AUTO CONSTANT SPEED."

d. Set the mixture control to "AUTO RICH."

e. Adjust the radiator air scoop as desired.

f. Adjust the power and trim to maintain 150 mph IAS in level flight.

g. Switch off the gun heater if used.

h. See that the tail wheel control is "LOCKED."

i. When the throttle is retarded so that 20 inches Hg is indicated on the manifold pressure gage, a warning horn will sound to indicate that the landing gear is not locked in its fully extended position. The horn will sound until the condition responsible for its operation has been removed, that is, until the landing gear is fully lowered and locked in place.

j. Lower the landing gear by pulling the landing gear handle inboard and pushing it down. Upon full extension of the landing gear, spring-loaded steel pins will drop behind the extended members and lock them securely in the extended position. When so locked, the warning horn will cease operating and a safe landing condition will thereby be indicated. The position of the landing gear should also be checked by the electrical indicator located on the left lower side

of the instrument panel. The instrument consists of three red lights, three green lights, and a test button for checking the correct operation of the lights. Indication that the landing gear is in the "DOWN-LOCKED" position is given when the three green lights are on. Indication that the gear is not in the "DOWN-LOCKED" position is given when the three red lights are on.

k. If desired, the flaps may be lowered 15 degrees to give a steeper approach angle. When the airplane has been brought into the wind for landing, the flaps should be lowered fully at an altitude of at least 400 feet, provided the indicated air speed is above 100 mph IAS. To lower the flaps, push the flap control handle to the desired position as marked. Check the movement of the flaps on the mechanical position indicator.

23. LANDING.

Having turned into the field and lowered the flaps, maintain a correct gliding speed of between 105 to 110 mph IAS. Adjust the elevator trim tab to assist in landing. Having stopped after landing, raise the flaps, turn off the fuel booster pump, and unlock the tail wheel.

a. MISLANDING. - In the case of an unsuccessful attempt to land, push the propeller control forward to increase rpm and open the throttle. Raise the landing gear immediately; then, when the air speed has reached 110 mph, raise the flaps.

b. CROSS-WIND LANDING. - As this airplane has a landing gear of wide tread and a locked tail wheel, cross-wind landings may be negotiated safely. Keep one wing down, into the wind, to counteract drift.

c. EMERGENCY OPERATION OF LANDING GEAR. In the event of a complete hydraulic failure when the landing gear is in the retracted position, proceed as follows:

(1) Pull the landing gear "DOWN EMERGENCY" knob on the left side of the instrument panel. This will release the hydraulic fluid in the landing gear system lines.

(2) Place the landing gear control handle in the "DOWN" position. This will allow the landing gear to drop of its own weight.

(3) After the landing gear has dropped downward, as shown by the landing gear position indicators located on top of the control pedestal at the left side of the cockpit, check the exact position of the landing gear and the down-lockpins by means of the electrical position indicator on the left side of the instrument panel.

(4) If the electrical indicators indicate that the gear is not locked, rock the wings of the airplane to throw the gear sideways into the fully extended and "LOCKED" position.

(5) Make a final check of the position of the landing gear by closing the throttle until the manifold pressure gage indicates less than 20 inches Hg. If the warning horn does not operate, the landing gear is fully extended and locked.

24. STOPPING THE ENGINE.

When the airplane has stopped rolling, proceed with the following:

a. Set the mixture control in the "IDLE CUT-OFF" position at 1200 rpm and move the throttle fully open.

b. Turn the ignition switch to the "OFF" position after the engine ceases firing.

c. Turn both fuel selector valves to "OFF."

d. Leave the mixture control lever at "IDLE CUT-OFF" as a precaution against accidental starting.

25. BEFORE LEAVING COCKPIT.

Before leaving the cockpit, make a general survey of the compartment and proceed as follows:

a. Apply the parking brake.

b. Lock the control surfaces. The lock is located just forward of the control stick.

c. Turn off the generator disconnect switch, all radio switches, and all light switches.

26. MANEUVERS PROHIBITED.

All normal maneuvers are permitted with this airplane except when external fuel tanks or bombs are installed. With the ferrying tanks installed, all acrobatics are prohibited and the stalling speed of the airplane is increased 10 mph.

SECTION III

FLIGHT OPERATION DATA

1. DETERMINING GROSS WEIGHT.

Refer to the WEIGHT AND BALANCE CHART in this section and check the listed basic and alternate tabulated items against those loaded in the airplane. If the airplane is loaded in accordance with the "Basic Load Items" whose weights are entered in the "Pounds" column, and the "Alternate Items" whose weights are entered under four loading conditions in the "Alternate Loading (Pounds)" column, the gross weight will be found listed at the bottom of the chart. If any items tabulated in the "Pounds" columns are omitted in the loading of the airplane, deduct the weight of the missing items from the "Gross Weight," and the answer will be the correct gross weight as the airplane is actually loaded.

2. FLIGHT PLANNING.

The following outline may be used as a guide to assist personnel in the use of FLIGHT OPERATION INSTRUCTION CHART for flight planning purposes.

a. If the flight plan calls for a continuous flight where the desired cruising power and air speed are reasonably constant after take-off and climb to 5000 feet, the fuel required and flight time may be computed as a "single section flight."

(1) Within the limits of the airplane, the fuel required and flying time for a given mission depend largely upon the speed desired. With all other factors remaining equal in an airplane, speed is obtained at a sacrifice of range, and range is obtained at a sacrifice of speed. The speed is usually determined after considering the urgency of the flight plotted against the range required. The time of take-off is adjusted so as to have the flight arrive at its destination at the predetermined time.

(2) Select the FLIGHT OPERATION INSTRUCTION CHART for the gross weight to be used at take-off. Locate the largest figure entered under GPH in column 1 on the lower half of the chart. Multiply this figure by the number and/or fraction of hours desired for reserve fuel. Add the resulting figure to the number of gallons set forth in footnote No. 2, and subtract the total from the amount of fuel in the airplane prior to starting of engine. The figure obtained as a result of this computation will represent the amount of gasoline available and applicable for flight planning purposes on the RANGE IN AIR MILES section of the FLIGHT OPERATION INSTRUCTION CHART.

(3) Select a figure in the fuel column equal to, or the next entry less than, the available amount of fuel in the airplane as determined in paragraph 2.a.(2) above. Move horizontally to the right or left and select a figure equal to, or the next entry greater than, the air miles (with no wind) to be flown. Operating values contained in the column number in which this figure appears, represent the highest cruising speed possible at the range desired; however, the airplane may be operated in accordance with values contained under OPERATING DATA in any column of a higher number with the flight plan being completed at a sacrifice of speed but at an increase in fuel economy.

(4) Using the same column number selected by application of instructions contained in paragraph 2.a.(3), determine the indicated air speed (in mph or knots, whichever is applicable to the calibration of instruments in the airplane) and gallons per hour listed at sea level in the lower section of the chart under the subtitle OPERATING DATA. Divide this "IAS" into the air miles to be flown and obtain the calculated flight duration in minutes, which can then be converted into hours and minutes and deducted from the desired arrival time and destination in order to obtain the take-off time (without consideration for wind). To allow for wind, use the above "IAS" as ground speed and calculate a new corrected ground speed with the aid of a flight calculator or by a navigator's triangle of velocities.

(5) The airplane and engine operating values listed below OPERATING DATA in any single numbered column are calculated to give constant miles per gallon at any altitude listed. Therefore, the airplane may be operated at any altitude and at the corresponding set of values given so long as they are in the same column listing the range desired.

CAUTION

Ranges listed in column 1 under "Max. Cont. Power" are correct only at the altitude given in footnote 1. For each column other than "I (MAX. CONT. POWER)," the data listed under OPERATING DATA will give the same miles per gallon if operation is consistent with any of the pairs of values of rpm, IAS, and with the mixture control set opposite the listed altitudes, mixture control being indicated by dark and light print.

(6) The flight plan may be readily changed at any time enroute, and the chart will show the balance of range at various cruising powers by following the INSTRUCTIONS FOR USING CHART printed on each page.

b. If the original flight plan calls for a mission requiring changes in power, speed, gross load, or external load, in accordance with "Gross Weight" or "External Items" increments shown in the series of FLIGHT OPERATION INSTRUCTION CHARTS provided, the total flight should be broken down into a series of individual short flights, each computed as outlined in paragraph 2.a. in its entirety, and then added together to make up the total flight and its requirements. Charts are provided for five loading conditions.

DEC. 18, 1942 FORM ASC-513

WEIGHT & BALANCE CHART

AIRPLANE MODELS	CG LIMITS (IN INCHES) AFT OF REFERENCE DATUM LINE CONDITION	F'W'D	AFT
	TAKE-OFF		29% MAC
A-36A-1-NA	LANDING	22% MAC	

BASIC WEIGHT ITEMS	POUNDS
WEIGHT EMPTY (INCLUDING TRAPPED FUEL AND OIL)	6815
EQUIPMENT:	
NAVIGATION ____ LB. PHOTOGRAPHIC ____ LB. OXYGEN 1 LB.	1
PYROTECHNICS (FLARES, ETC.) 4 LB.	4
ARMAMENT:	
FIXED GUN INSTALLATION(S): (6) .50 CAL. 416 LB.; ( ) ____ CAL. ____ LB.; GUN SIGHT 4 LB.	420
FLEXIBLE GUN INSTALLATION(S): ( ) ____ CAL. ____ LB.; ( ) ____ CAL. ____ LB.	
CANNON INSTALLATION(S): ( ) ____ MM. ____ LB.; ( ) ____ MM. ____ LB.	
RADIO: MODEL(S) SCR-274N & SCR-535A	
TOTAL BASIC WEIGHT (CG ____ INCHES AFT OF REFERENCE DATUM LINE)	7240

ITEMS OF USEFUL LOAD	U.S. GAL.	(IMP. GAL.)	ALTERNATE LOADINGS (POUNDS) MAXIMUM FUEL	NORMAL FUEL	COMBAT FUEL	BOMBING LOADING
PILOT (200 LB. INCLUDING PARACHUTE)			200	200	200	200
CREW (200 LB. EACH INCLUDING PARACHUTE)						
PASSENGERS (200 LB. EACH INCLUDING PARACHUTES)						
BAGGAGE (____ LB. MAXIMUM)						
FUEL (6 LB/U.S. GAL. OR 7.2 LB/IMP. GAL.):						
WING TANKS - NORMAL	105	(90)		630		
WING TANKS - FULL	180	(150)	1080		1080	1080
DROPPABLE COMBAT TANKS	150	(125)			900	
DROPPABLE FERRYING TANKS	300	(250)	1800			
		( )				
		( )				
OIL (7.5 LB/U.S. GAL. OR 9 LB/IMP. GAL.):	8	(6.7)	60	60	60	60
EXTRA	4	(3.3)	30		30	30
EXTRA TANK(S) INSTALLATION COMBAT: 120; FERRYING: 210			210		120	
BOMB INSTALLATION(S): ( ) INTERNAL AT ____ LB. EACH						
(2) EXTERNAL AT 500 LB. EACH OR						
(2) EXTERNAL AT 300 LB. EACH OR						
(MAX. SHOWN) (2) EXTERNAL AT 250 LB. EACH						1010
TORPEDO INSTALLATION						
AMMUNITION						
(1400) RD. OF .50 CAL.; ( ) RD. OF ____ CAL.				420	420	420
( ) RD. OF ____ MM.; ( ) RD. OF ____ MM.						
MISC. EQUIPMENT CARRIED IN FERRYING			80			
GROSS WEIGHT			10,700	8,600	10,000	10,000
% MAC			26.9	24.6	25.9	25.6

SPEC. AN-H-8
DEC. 18, 1942
FORM ASC-512

AIRPLANE MODELS A-36A

SPECIFIC ENGINE FLIGHT CHART

ENGINE MODELS V-1710-87

CONDITION	FUEL PRESSURE (LB/SQ. IN.)	OIL PRESSURE (LB/SQ. IN.)	OIL TEMP. °C	OIL TEMP. °F	COOLANT TEMP. °C	COOLANT TEMP. °F		
DESIRED	12-16	60-70	60-80	140-176	105-115	221-239		
MAXIMUM	16	85	95	203	125	257		
MINIMUM	12	55	20	68	85	185		
IDLING	9	15						

MAX. PERMISSIBLE DIVING RPM: 3120

CONDITION	ALLOWABLE OIL CONSUMPTION
MAX. CONT.	15.7 U.S.QT/HR 26.2 IMP.PT/HR
MAX. CRUISE	11 U.S.QT/HR 18.3 IMP.PT/HR
MIN. SPECIFIC	7 U.S.QT/HR 11.7 IMP.PT/HR

OIL GRADE: (S) 1120 (W) 1120

SUPERCHARGER TYPE: ENGINE DRIVEN — SINGLE SPEED, SINGLE STAGE **FUEL GRADE:** AN-F-28 **OCTANE** 100

OPERATING CONDITION	RPM	MANIFOLD PRESSURE (BOOST)	HORSE-POWER	CRITICAL ALTITUDE WITH RAM	CRITICAL ALTITUDE NO RAM	BLOWER	USE LOW BLOWER BELOW:	MIXTURE CONTROL POSITION	FUEL FLOW (GAL/HR/ENG.) U.S.	FUEL FLOW (GAL/HR/ENG.) IMP.	MAXIMUM CYL. TEMP. °C	MAXIMUM CYL. TEMP. °F	MAXIMUM DURATION (MINUTES)
TAKE-OFF	3000	47	1325	SEA LEVEL				AUTO RICH	155	129			5
WAR EMERGENCY	3000	52	1500	2500				AUTO RICH	170	142			5
MILITARY	3000	46.5	1325	5400				AUTO RICH	155	125			15
MAXIMUM CONTINUOUS	2600	41	1100	6600		SINGLE SPEED BLOWER		AUTO RICH	136	114			
MAXIMUM CRUISE	2280	F.T.	790	9000				AUTO LEAN	60	50			
MINIMUM SPECIFIC CONSUMPTION	1650	29	425	SEA LEVEL				AUTO LEAN	32	27			
	1650	28	480	5000					36	30			
	1650	F.T.	490	10,000					37	31			
	1850	F.T.	490	15,000					39	33			
	2100	F.T.	470	20,000					43	36			

REMARKS: *DATA FOR MINIMUM SPECIFIC CONSUMPTION ARE FOR AVERAGE MAXIMUM RANGE CONDITIONS.*

SPEC. AN-H-8 Dec. 18, 1942 FORM ASC-510

AIRPLANE MODELS

A-36A

(WITH OR WITHOUT EXTERNAL LOADS)

TAKE-OFF, CLIMB & LANDING CHART

ENGINE MODELS

V-1710-87

TAKE-OFF DISTANCE (IN FEET)

GROSS WEIGHT (IN LBS.)	HEAD WIND		HARD SURFACE RUNWAY						SOD-TURF RUNWAY						SOFT SURFACE RUNWAY					
			AT SEA LEVEL		AT 3,000 FT.		AT 6,000 FT.		AT SEA LEVEL		AT 3,000 FT.		AT 6,000 FT.		AT SEA LEVEL		AT 3,000 FT.		AT 6,000 FT.	
	MPH	KNOTS	GROUND RUN	TO CLEAR 50' OBJ.	GROUND RUN	TO CLEAR 50' OBJ.	GROUND RUN	TO CLEAR 50' OBJ.	GROUND RUN	TO CLEAR 50' OBJ.	GROUND RUN	TO CLEAR 50' OBJ.	GROUND RUN	TO CLEAR 50' OBJ.	GROUND RUN	TO CLEAR 50' OBJ.	GROUND RUN	TO CLEAR 50' OBJ.	GROUND RUN	TO CLEAR 50' OBJ.
9,000	0	0	1800	2500	2050	2800	2650	3500	1900	2500	2150	2900	2950	3700	2250	2950	2600	3300	3500	4300
	20	17	1200	1750	1400	2000	1850	2500	1300	1850	1500	2050	2000	2650	1500	2050	1750	2350	2400	3100
	40	35	750	1150	900	1350	1200	1700	800	1200	950	1400	1300	1800	900	1200	1100	1550	1550	2100
10,000	0	0	2250	3150	2600	3400	3400	4300	2400	3200	2800	3600	3800	4500	2900	3700	3400	4200	4600	5500
	20	17	1550	2150	1750	2400	2400	3200	1700	2300	1900	2600	2600	3400	2000	2500	2350	3000	3300	4100
	40	35	950	1450	1150	1700	1600	2200	1050	1500	1250	1750	1700	2300	1250	1750	1500	2050	2150	2800
11,000	0	0	2800	3600	3200	4100	4200	5300	3000	3900	3500	4400	4600	5700	3700	4600	4400	5300	6100	7200
	20	17	1950	2650	2200	2900	3000	3900	2100	2800	2400	3200	3300	4200	2600	3300	3100	3900	4400	5300
	40	35	1250	1800	1500	2100	2000	2750	1350	1900	1600	2200	2200	2900	1650	2200	2050	2800	3000	3700

NOTE: INCREASE DISTANCE 10 % FOR EACH 10°C ABOVE 0°C (10 % FOR EACH 20°F ABOVE 32°F)

ENGINE LIMITS FOR TAKE-OFF 3000 RPM & 47 IN. HG

CLIMB DATA

COMBAT MISSIONS USE 2600 RPM & 41 IN. HG

FERRY MISSIONS USE 2280 RPM & 31.5 IN. HG

GROSS WEIGHT IN LBS.	TYPE OF CLIMB	S. L. TO 4,000 FT. ALT.				8,000 FT. ALT.						12,000 FT ALT						16,000 FT. ALT.						20,000 FT. ALT.						BLOWER CHANGE
		BEST I.A.S.		FT/MIN	TIME FROM S. L.	BEST I.A.S.		FT/MIN	TIME FROM S. L.	FUEL FROM S.L.		BEST I.A.S		FT/MIN	TIME FROM S. L	FUEL FROM S L		BEST I.A.S.		FT/MIN	TIME FROM S L.	FUEL FROM S L.		BEST I.A,S.		FT/MIN	TIME FROM S. L.	FUEL FROM S.L.		
		MPH	KNOTS			MPH	KNOTS			U S.	IMP.	MPH	KNOTS			U S	IMP.	MPH	KNOTS			U.S	IMP.	MPH	KNOTS			U.S.	IMP.	
11,000	COMBAT	150	130	1225	3	150	140	1075	7	17	14	140	140	750	11	22.5	19	135	135	400	18	30	25	150	30	100	33	44	36	
	FERRY	-	140	950	4	150	140	800	9.5	12.5	10	140	140	450	14.5	18.5	15	135	135	150	27	30	25	-	-	-	-	-	-	
10,000	COMBAT	160	140	1500	2.5	160	140	1350	5.5	15	12.5	160	140	1000	8.5	19	16	150	140	650	14	24	20	155	135	300	22	31	26	
	FERRY	165	143	1200	3	165	143	1050	6.5	16.5	9	165	143	700	11	20	17	150	140	350	18.5	22	19	155	135	50	37	39	32	
9,000	COMBAT	160	140	1925	2	160	140	1750	4.5	12.5	10	160	140	1375	7	15.5	13	155	135	1000	10	19	16	150	130	600	15	24	20	
	FERRY	165	143	1670	2.6	165	143	1425	5.2	9	7.5	165	143	1050	5	12	10	150	140	650	12.5	17	14	155	135	300	20	23	19	

NOTE: INCREASED ELAPSED CLIMBING TIME 10 % FOR EACH 10°C ABOVE 0°C FREE AIR TEMPERATURE (10 % FOR EACH 20°F ABOVE 32°F) FUEL INCLUDES WARM-UP AND TAKE-OFF ALLOWANCE

LANDING DISTANCE (IN FEET)

GROSS WEIGHT IN LBS.	BEST I. A. S. APPROACH		HARD DRY SURFACE						FIRM DRY SOD						WET OR SLIPPERY					
			AT SEA LEVEL		AT 3,000 FT.		AT 6,000 FT.		AT SEA LEVEL		AT 3,000 FT.		AT 6,000 FT.		AT SEA LEVEL		AT 3,000 FT.		AT 6,000 FT.	
	MPH	KNOTS	TO CLEAR 50' OBJ.	GROUND ROLL	TO CLEAR 50' OBJ.	GROUND ROLL	TO CLEAR 50' OBJ.	GROUND ROLL	TO CLEAR 50' OBJ.	GROUND ROLL	TO CLEAR 50' OBJ.	GROUND ROLL	TO CLEAR 50' OBJ.	GROUND ROLL	TO CLEAR 50' OBJ.	GROUND ROLL	TO CLEAR 50' OBJ.	GROUND ROLL	TO CLEAR 50' OBJ.	GROUND ROLL
9,000	110	95	2500	1600	3000	2100	3300	2300	3000	2100	3200	2300	3500	2500	5500	4000	5000	5000	5500	5500
8,000	105	91	2500	1700	2700	1800	3000	2000	2700	1900	2900	2000	3200	2200	5000	4100	5400	4500	5400	4900

NOTE: FOR GROUND TEMPERATURES ABOVE 35°C (95°F) INCREASE APPROACH I.A.S. 10% AND ALLOW 20% INCREASE IN GROUND ROLL.

REMARKS

LEGEND
- I.A.S.: Indicated Air Speed
- M.P.H.: Miles Per Hour
- S.L.: Sea Level
- U.S.: U. S. Gallons
- IMP.: Imperial Gallons
- NOTE: All Distances are Average
- RED FIGURES HAVE NOT BEEN FLIGHT CHECKED

SPEC. AN-N-8 DEC. 18, 1942 — FORM ASC-511

MODEL (S) A-36A

FLIGHT OPERATION INSTRUCTION CHART

SHEET 1 OF 4 SHEETS

GR. WT. 9100 TO 8000 POUNDS

EXTERNAL LOAD ITEMS
NONE

CONDITION	R.P.M.	M.P. (IN HG)	BLOWER POSITION	MIXTURE POSITION	DURATION IN MIN.	U.S G.P.H.	IMP. G.P.H.
TAKE-OFF	3000	47	-	A.R.	5	143	119
MILITARY POWER	3000	46.5	-	A.R.	15	143	119
ENGINE (S)	V - 1710-87						

INSTRUCTIONS FOR USING CHART: Select figure in fuel column equal to or less than total amount of fuel in airplane. Move horizontally to the right or left and select a figure equal to or greater than the air miles to be flown. Vertically below and opposite desired cruising altitude read optimum cruising conditions. *NOTES:* (A) Avoid continuous cruising in Column I except in emergency. (B) Columns (II, III, IV & V) toward the right progressively give increase in range at sacrifice in speed. (C) Manifold Pressure (M.P.), Gallons Per Hour (G.P.H.), are approximate maximum values for reference. (D) For quick reference, take-off and military power data are listed in the upper left corner of chart.

ALTERNATE CRUISING CONDITIONS

(NO WIND) — (NO RESERVE FUEL ALLOWANCE)

I (MAX. CONT. POWER) RANGE IN AIR MILES				FUEL U.S. GALS. (2)	II RANGE IN AIR MILES		III RANGE IN AIR MILES		IV RANGE IN AIR MILES		FUEL IMP. GALS. (2)	V (MAX. RANGE) RANGE IN AIR MILES	
STATUTE		NAUTICAL			STATUTE	NAUTICAL	STATUTE	NAUTICAL	STATUTE	NAUTICAL		STATUTE	NAUTICAL
AT S.L.	AT 6,000	AT S.L.	AT 6,000										
	400		350	180	10 U.S. (8 Imp.) gallons not available in flight.						150		
	360		310	170	660	570	770	670	880	760	142	1100	960
				150	580	510	680	590	780	670	125	970	840
	310		270	130	500	440	590	510	670	580	118	840	730
	260		230	110	430	370	500	430	570	490	92	710	620
	210		180	90	350	300	410	350	470	400	75	580	500
	160		140	70	270	230	320	270	360	310	58	450	390
	120		100	50	190	170	230	200	260	220	42	320	280
	70		60	30	110	100	140	120	150	130	25	190	170
	20		20	10	40	30	40	40	50	40	8	70	60

OPERATING DATA						(1) DENSITY ALT. IN FEET	OPERATING DATA						OPERATING DATA						OPERATING DATA						(1) DENSITY ALT. IN FEET	OPERATING DATA					
R.P.M.	I.A.S. M.P.H.	I.A.S. KNOTS	M.P. IN Hg	U.S. G.P.H	IMP. G.P.H		R.P.M.	I.A.S. M.P.H.	I.A.S. KNOTS	M.P. IN Hg	U.S. G.P.H.	IMP. G.P.H.	R.P.M.	I.A.S. M.P.H.	I.A.S. KNOTS	M.P. IN Hg	U.S. G.P.H	IMP. G.P.H	R.P.M.	I.A.S. M.P.H.	I.A.S. KNOTS	M.P. IN Hg	U.S. G.P.H.	IMP. G.P.H.		R.P.M.	I.A.S. M.P.H.	I.A.S. KNOTS	M.P. IN Hg	U.S. G.P.H.	IMP. G.P.H.
						30000																			30000					
						25000																			25000					
2600	309	268	F.T.	62	52	20000													2500	220	190	F.T.	58	48	20000					
2600	317	275	F.T.	64	53	15000							2600	250	215	F.T.	64		2450	240	205	F.T.	59	49	15000	1800	195	170	F.T.	36	33
2600	318	276	F.T.	71	59	12000	2600	260	225	F.T.	71	59	2550	255	220	F.T.	69		2300	245	210	F.T.	57	47	12000	1750	205	180	F.T.	33	32
2600	319	277	F.T.	84	70	9000	2550	270	235	F.T.	80	67	2400	260	225	31.5	66		2300	250	215	F.T.	57	47	9000	1650	205	180	26	47	31
2500	324	281	41	136	113	6000	2400	275	240	F.T.	77	64	2300	260	225	F.T.	64		2250	245	210	30.5	53	44	6000	1650	200	175	27	44	28
2600	311	270	41	120	100	3000	2400	275	240	34	74	62	2300	260	225	33	61		2100	245	210	31	51	42	3000	1650	195	170	28	42	27
2600	295	256	41	105	87	S.L.	2400	275	240	35.5	74	62	2300	265	230	33.5	59		2000	245	210	31.5	50	41	S.L.	1650	190	165	29	31	26

LEGEND

(1) INDICATED ALTITUDE CORRECTED FOR FREE AIR TEMPERATURE.

(2) ALLOW 10 U. S. GALS. 8 IMP. GALS. FOR WARM UP,
TAKE-OFF AND CLIMB TO 5,000 FEET ALTITUDE
RETURN FUEL FLOWS TO TANK -
USE FUEL FROM TANKS IN THE FOLLOWING ORDER

REFER TO "SPECIFIC ENGINE FLIGHT CHART" FOR ADDITIONAL ENGINE OPERATION DATA.

BOLD NUMBERS: Use Auto-Rich
LIGHT NUMBERS: Use Auto-Lean
WITH TWO SPEED BLOWER: Use high blower above heavy line only

I.A.S.: Indicated Air Speed
M.P.: Manifold Pressure (In. Hg)
U.S.G.P.H.: U. S. Gallons Per Hour
IMP.G.P.H.: Imperial Gallons Per Hour
F.T.: Full Throttle
S.L.: Sea Level

RED FIGURES ARE PRELIMINARY: SUBJECT TO REVISION AFTER FLIGHT CHECK

SPEC. AN-H-8 DEC. 16,1942 FORM ASC-511

MODEL (S) A-36A

FLIGHT OPERATION INSTRUCTION CHART

SHEET 2 OF 4 SHEETS

GR. WT. 10,800 TO 9,000 POUNDS

EXTERNAL LOAD ITEMS
(2) 150 GAL. FERRY TANKS

CONDITION	R.P.M.	M.P. IN HG	BLOWER POSITION	MIXTURE POSITION	DURATION IN MIN.	U.S. G.P.H.	IMP. G.P.H.
TAKE-OFF	3000	47	-	A.R.	5	143	119
MILITARY POWER	3000	46.5	-	A.R.	15	143	119
ENGINE (S)	V 1710-87						

INSTRUCTIONS FOR USING CHART: Select figure in fuel column equal to or less than total amount of fuel in airplane. Move horizontally to the right or left and select a figure equal to or greater than the air miles to be flown. Vertically below and opposite desired cruising altitude read optimum cruising conditions. *NOTES:* (A) Avoid continuous cruising in Column I except in emergency. (B) Columns (II, III, IV & V) toward the right progressively give increase in range at sacrifice in speed. (C) Manifold Pressure (M.P.), Gallons Per Hour (G.P.H.), are approximate maximum values for reference. (D) For quick reference, take-off and military power data are listed in the upper left corner of chart.

ALTERNATE CRUISING CONDITIONS

(NO WIND) (NO RESERVE FUEL ALLOWANCE)

I (MAX. CONT. POWER) RANGE IN AIR MILES				FUEL U.S. GALS. (2)	II RANGE IN AIR MILES		III RANGE IN AIR MILES		IV RANGE IN AIR MILES		FUEL IMP. GALS. (2)	V (MAX. RANGE) RANGE IN AIR MILES	
STATUTE		NAUTICAL			STATUTE	NAUTICAL	STATUTE	NAUTICAL	STATUTE	NAUTICAL		STATUTE	NAUTICAL
AT S.L.	AT 6,000	AT S.L.	AT 6,000										
				480	20 U.S. (17 IMP.) Gallons not available in flight.						400		
	1030		890	450	1500	1300	1760	1530	2000	1740	383	2510	2180
	890		780	400	1300	1130	1530	1330	1740	1510	333	2180	1900
	780		680	350	1140	990	1340	1160	1520	1320	292	1910	1660
	670		580	300	970	850	1150	1000	1300	1130	250	1640	1420
	560		480	250	810	700	960	830	1090	940	208	1360	1180
	450		390	200	850	560	770	660	870	750	167	1090	950
	330		290	150	490	420	570	500	650	570	125	820	710

OPERATING DATA						(1) DENSITY ALT. IN FEET	OPERATING DATA						OPERATING DATA						OPERATING DATA						(1) DENSITY ALT. IN FEET	OPERATING DATA					
R.P.M.	I.A.S. M.P.H	I.A.S. KNOTS	M.P. IN Hg	U.S. G.P.H	IMP. G.P.H		R.P.M.	I.A.S. M.P.H.	I.A.S. KNOTS	M.P. IN Hg	U.S. G.P.H	IMP G.P.H	R.P.M.	I.A.S. M.P.H.	I.A.S. KNOTS	M.P. IN Hg	U.S. G.P.H.	IMP G.P.H.	R.P.M.	I.A.S. M.P.H.	I.A.S. KNOTS	M.P. IN Hg	U.S. G.P.H	IMP G.P.H.		R.P.M.	I.A.S. M.P.H.	I.A.S. KNOTS	M.P. IN. Hg	U.S. G.P.H	IMP. G.P.H.
						30000																			30000					
						25000																			25000					
						20000																			20000					
2600	283	246	F.T.	64	53	15000																			15000	2150	195	170	F.T.	48	40
2600	286	250	F.T.	71	59	12000													2550	230	200	F.T.	69	58	12000	2000	200	175	F.T.	47	39
2600	289	251	F.T.	90	70	9000	2600	250	215	F.T.	90	70	2500	245	210	F.T.	78	65	2400	235	205	F.T.	66	50	9000	1900	200	175	28	46	38
2600	290	252	41	136	113	6000	2450	250	215	F.T.	89	74	2350	245	210	34	73	61	2300	240	210	33	65	54	6000	1650	195	170	29	44	37
2600	277	240	41	119	99	3000	2450	250	215	36	87	72	2350	245	210	35	73	61	2300	240	210	33	61	51	3000	1650	190	165	29	39	32
2600	265	230	41	106	88	S. L.	2450	250	215	36	82	68	2350	245	210	34.5	68	57	2250	240	210	33.5	59	49	S. L.	1650	185	160	29	37	31

LEGEND

(1) INDICATED ALTITUDE CORRECTED FOR FREE AIR TEMPERATURE.

(2) ALLOW 20 U. S. GALS., 17 IMP. GALS. FOR WARM UP.

TAKE-OFF AND CLIMB TO 5,000 FEET ALTITUDE

RETURN FUEL FLOWS TO TANK -

USE FUEL FROM TANKS IN THE FOLLOWING ORDER

BOLD NUMBERS: Use Auto-Rich
LIGHT NUMBERS Use Auto-Lean
WITH TWO SPEED BLOWER: Use high blower above heavy line only

I.A.S.: Indicated Air Speed
M.P.: Manifold Pressure (In. Hg)
U.S.G.P.H.: U. S. Gallons Per Hour
IMP.G.P.H.: Imperial Gallons Per Hour
F.T.: Full Throttle
S.L.: Sea Level

REFER TO "SPECIFIC ENGINE FLIGHT CHART" FOR ADDITIONAL ENGINE OPERATION DATA.

RED FIGURES ARE PRELIMINARY: SUBJECT TO REVISION AFTER FLIGHT CHECK

SPEC. AN-H-8 DEC. 18, 1942 — FORM ASC-511

MODEL (S) A-36A

FLIGHT OPERATION INSTRUCTION CHART

SHEET 3 OF 4 SHEETS

GR. WT. 9,000 TO 7,500 POUNDS

EXTERNAL LOAD ITEMS
(2) 150 GAL. FERRY TANKS

CONDITION	R.P.M.	M.P. (IN HG)	BLOWER POSITION	MIXTURE POSITION	DURATION IN MIN.	U.S G.P.H.	IMP. G.P.H.
TAKE-OFF	3000	47	-	A.R.	5	143	119
MILITARY POWER	3000	46.5	-	A.R.	15	143	119
ENGINE (S)	V 1710-87						

INSTRUCTIONS FOR USING CHART: Select figure in fuel column equal to or less than total amount of fuel in airplane. Move horizontally to the right or left and select a figure equal to or greater than the air miles to be flown. Vertically below and opposite desired cruising altitude read optimum cruising conditions. *NOTES:* (A) Avoid continuous cruising in Column I except in emergency. (B) Columns (II, III, IV & V) toward the right progressively give increase in range at sacrifice in speed. (C) Manifold Pressure (M.P.), Gallons Per Hour (G.P.H.), are approximate maximum values for reference. (D) For quick reference, take-off and military power data are listed in the upper left corner of chart.

ALTERNATE CRUISING CONDITIONS

(NO WIND) (NO RESERVE FUEL ALLOWANCE)

I (MAX. CONT. POWER) RANGE IN AIR MILES				FUEL U.S. GALS. (2)	II RANGE IN AIR MILES		III RANGE IN AIR MILES		IV RANGE IN AIR MILES		FUEL IMP. GALS. (2)	V (MAX. RANGE) RANGE IN AIR MILES	
STATUTE		NAUTICAL			STATUTE	NAUTICAL	STATUTE	NAUTICAL	STATUTE	NAUTICAL		STATUTE	NAUTICAL
AT S.L.	AT 6,000	AT S.L.	AT 6,000										
				180	10 U.S. (8 Imp.) gallons not available in flight.						150		
	350		310	170	630	540	740	640	840	730	142	1050	910
	310		270	150	550	480	650	560	740	640	125	930	810
	270		230	130	480	420	560	490	640	550	108	800	700
	230		200	110	400	350	480	410	540	470	92	680	590
	180		160	90	330	290	390	340	440	380	75	560	480
	140		120	70	260	220	300	260	340	300	58	430	370
	100		90	50	180	160	220	190	250	210	42	310	270
	60		50	30	110	90	130	110	150	130	25	180	160
	20		20	10	40	30	40	40	50	40	8	60	50

OPERATING DATA						(1) DENSITY ALT. IN FEET	OPERATING DATA						OPERATING DATA						OPERATING DATA						(1) DENSITY ALT. IN FEET	OPERATING DATA					
R.P.M.	I.A.S. M.P.H.	I.A.S. KNOTS	M.P. IN Hg	U.S. G.P.H.	IMP. G.P.H.		R.P.M.	I.A.S. M.P.H.	I.A.S. KNOTS	M.P. IN Hg	U.S. G.P.H.	IMP. G.P.H.	R.P.M.	I.A.S. M.P.H.	I.A.S. KNOTS	M.P. IN Hg	U.S. G.P.H.	IMP. G.P.H.	R.P.M.	I.A.S. M.P.H.	I.A.S. KNOTS	M.P. IN Hg	U.S. G.P.H.	IMP. G.P.H.		R.P.M.	I.A.S. M.P.H.	I.A.S. KNOTS	M.P. IN Hg	U.S. G.P.H.	IMP. G.P.H.
						30000																			30000					
						25000																			25000					
						20000																			20000					
2600	285	247	F.T.	64	53	15000							2600	225	195	F.T.	54	53	2400	220	190	F.T.	56	47	15000					
2600	288	250	F.T.	71	59	12000	2600	235	205	F.T.	71	59	2500	230	200	F.T.	65	54	2250	225	195	F.T.	56	47	12000	1650	150	130	F.T.	35	29
2600	289	251	F.T.	84	70	9000	2500	245	210	F.T.	78	65	2350	235	205	F.T.	63	53	2200	225	195	29.5	54	45	9000	1650	175	150	25	33	28
2600	290	252	41	136	113	6000	2350	245	210	34	75	62	2300	235	205	32	61	51	2100	220	190	30	51	42	6000	1650	175	150	26	32	27
2600	277	240	41	119	99	3000	2350	245	210	34.5	70	58	2300	235	205	32.5	58	48	2000	220	190	30.5	45	40	3000	1650	175	150	27	41	26
2600	265	230	41	105	87	S.L.	2350	245	210	34.5	68	57	2250	245	205	32	56	47	1900	220	190	31	46	38	S.L.	1650	175	150	28	30	25

LEGEND

(1) INDICATED ALTITUDE CORRECTED FOR FREE AIR TEMPERATURE.

(2) ALLOW 10 U. S. GALS., 8 IMP. GALS. FOR WARM UP.
TAKE-OFF AND CLIMB TO 5,000 FEET ALTITUDE
RETURN FUEL FLOWS TO TANK -
USE FUEL FROM TANKS IN THE FOLLOWING ORDER

REFER TO "SPECIFIC ENGINE FLIGHT CHART" FOR ADDITIONAL ENGINE OPERATION DATA

BOLD NUMBERS: Use Auto-Rich
LIGHT NUMBERS Use Auto-Lean
WITH TWO SPEED BLOWER- Use high blower above heavy line only

I.A.S.- Indicated Air Speed
M.P.: Manifold Pressure (In. Hg)
U.S G.P.H.: U. S. Gallons Per Hour
IMP.G P.H.. Imperial Gallons Per Hour
F.T.- Full Throttle
S.L. Sea Level

RED FIGURES ARE PRELIMINARY: SUBJECT TO REVISION AFTER FLIGHT CHECK

SPEC. AN-NO DEC. 16, 1942 — AAF ASC-511

MODEL (S)

A-36 A

FLIGHT OPERATION INSTRUCTION CHART

SHEET 4 OF 4 SHEETS

GR. WT. 10,100 TO 8,500 POUNDS

EXTERNAL LOAD ITEMS
(2) 300 LB. OR (2) 500 LB. BOMBS

CONDITION	R.P.M.	M.P. (IN HG.)	BLOWER POSITION	MIXTURE POSITION	DURATION IN MIN.	U.S. G.P.H.	IMP. G.P.H.
TAKE-OFF	3000	47	-	A.R.	5	143	119
MILITARY POWER	3000	46.5	-	A.R.	15	143	119
ENGINE (S)	V 1710-87						

INSTRUCTIONS FOR USING CHART: Select figure in fuel column equal to or less than total amount of fuel in airplane. Move horizontally to the right or left and select a figure equal to or greater than the air miles to be flown. Vertically below and opposite desired cruising altitude read optimum cruising conditions. *NOTES:* (A) Avoid continuous cruising in Column I except in emergency. (B) Columns (II, III, IV & V) toward the right progressively give increase in range at sacrifice in speed. (C) Manifold Pressure (M.P.), Gallons Per Hour (G.P.H.), are approximate maximum values for reference. (D) For quick reference, take-off and military power data are listed in the upper left corner of chart.

(NO WIND)

ALTERNATE CRUISING CONDITIONS

(NO RESERVE FUEL ALLOWANCE)

I (MAX. CONT. POWER) RANGE IN AIR MILES STATUTE AT S.L.	I STATUTE AT 6,000	I NAUTICAL AT S.L.	I NAUTICAL AT 6,000	FUEL U.S. GALS. (2)	II RANGE IN AIR MILES STATUTE	II NAUTICAL	III RANGE IN AIR MILES STATUTE	III NAUTICAL	IV RANGE IN AIR MILES STATUTE	IV NAUTICAL	FUEL IMP. GALS. (2)	V (MAX. RANGE) RANGE IN AIR MILES STATUTE	V NAUTICAL
				180	10 U.S. (8 Imp.) Gallons		not available	in flight.			150		
	370		320	170	550	470	640	560	730	640	142	920	800
	320		280	150	480	420	560	480	650	560	125	810	700
	280		240	130	420	360	490	420	550	480	108	700	610
	240		210	110	350	310	410	360	470	410	92	590	510
	190		170	90	290	250	340	290	390	330	75	480	420
	150		130	70	220	190	260	230	300	260	58	380	320
	110		90	50	160	140	190	160	210	190	42	270	230
	60		50	30	90	80	110	190	130	110	25	160	140
	20		20	10	30	20	40	30	40	40	8	50	40

OPERATING DATA R.P.M.	I.A.S. M.P.H.	I.A.S. KNOTS	M.P. IN Hg	U.S. G.P.H.	IMP. G.P.H.	(1) DENSITY ALT. IN FEET	OPERATING DATA R.P.M.	I.A.S. M.P.H.	I.A.S. KNOTS	M.P. IN Hg	U.S. G.P.H.	IMP. G.P.H.	OPERATING DATA R.P.M.	I.A.S. M.P.H.	I.A.S. KNOTS	M.P. IN Hg	U.S. G.P.H.	IMP. G.P.H.	OPERATING DATA R.P.M.	I.A.S. M.P.H.	I.A.S. KNOTS	M.P. IN Hg	U.S. G.P.H.	IMP. G.P.H.	(1) DENSITY ALT. IN FEET	OPERATING DATA R.P.M.	I.A.S. M.P.H.	I.A.S. KNOTS	M.P. IN Hg	U.S. G.P.H.	IMP. G.P.H.
						30000																			30000						
						25000																			25000						
						20000																			20000						
2600	285	250	F.T.	64	53	15000													2600	225	195	F.T.	64	53	15000	2040	190	165	F.T.	45	38
2600	290	250	F.T.	71	59	12000							2600	240	210	F.T.	71	59	2500	235	205	F.T.	65	54	12000	1920	195	170	F.T.	44	37
2600	295	255	F.T.	84	70	9000	2600	255	220	F.T.	84	70	2500	250	215	F.T.	78	65	2400	240	210	F.T.	65	54	9000	1850	200	175	F.T.	43	36
2600	297	260	41	136	113	6000	2450	255	220	F.T.	90	75	2350	250	215	33.5	74	62	2300	240	210	32	62	52	6000	1700	190	165	28.5	40	33
2600	285	250	41	120	99	3000	2450	255	220	F.T.	87	72	2350	250	215	34.5	71	59	2300	240	210	32.5	59	49	3000	1650	185	160	29	37	31
2600	275	240	41	105	87	S.L.	2450	260	225	36.5	83	69	2350	250	215	34.5	68	57	2300	240	210	32	56	47	S.L.	1060	185	160	30	36	30

LEGEND

(1) INDICATED ALTITUDE CORRECTED FOR FREE AIR TEMPERATURE.

(2) ALLOW 10 U. S. GALS. 8 IMP. GALS. FOR WARM UP.
TAKE-OFF AND CLIMB TO 5,000 FEET ALTITUDE
RETURN FUEL FLOWS TO TANK -
USE FUEL FROM TANKS IN THE FOLLOWING ORDER

REFER TO "SPECIFIC ENGINE FLIGHT CHART" FOR ADDITIONAL ENGINE OPERATION DATA.

BOLD NUMBERS: Use Auto-Rich
LIGHT NUMBERS: Use Auto-Lean
WITH TWO SPEED BLOWER: Use high blower above heavy line only

I.A.S.: Indicated Air Speed
M.P.: Manifold Pressure (In. Hg)
U.S.G.P.H.: U. S. Gallons Per Hour
IMP.G.P.H.: Imperial Gallons Per Hour
F.T.: Full Throttle
S.L.: Sea Level

RED FIGURES ARE PRELIMINARY: SUBJECT TO REVISION AFTER FLIGHT CHECK

MODEL(S) A-36A-1-NA

FLIGHT OPERATION INSTRUCTION CHART

GR. WT. 10,100 TO 9000 POUNDS

SHEET 5 OF 5 SHEETS

EXTERNAL LOAD ITEMS 2-500 LB. BOMBS

CONDITION	R.P.M.	M.P. (IN. HG)	BLOWER POSITION	MIXTURE POSITION	DURATION IN MIN.
TAKE-OFF ②	3000	47.0		AUTO RICH	5
MILITARY POWER ②	3000	46.5		AUTO RICH	15

ENGINE(S) V-1710-87

INSTRUCTIONS FOR USING CHART: SELECT FIGURE IN FUEL COLUMN EQUAL TO OR LESS THAN TOTAL AMOUNT OF FUEL IN AIRPLANE. (AVOID CONTINUOUS CRUISING IN COLUMN I EXCEPT IN EMERGENCY). MOVE HORIZONTALLY TO THE RIGHT OR LEFT AND SELECT A FIGURE EQUAL TO OR GREATER THAN THE AIR MILES TO BE FLOWN. VERTICALLY BELOW AND OPPOSITE DESIRED CRUISING ALTITUDE READ OPTIMUM CRUISING CONDITIONS. NOTES: (A) VERTICAL COLUMNS (I, II, III, IV, V & VI) TOWARD THE RIGHT PROGRESSIVELY GIVE INCREASE IN RANGE AT SACRIFICE IN SPEED. (B) MANIFOLD PRESSURE (M.P.), GALLONS PER HOUR (G.P.H.), & TRUE AIRSPEED ARE APPROXIMATE MAXIMUM VALUES FOR REFERENCE. (C) FOR QUICK REFERENCE, TAKE-OFF & MILITARY POWER DATA ARE LISTED IN THE UPPER LEFT-HAND CORNER OF THE CHART.

(NO WIND) ALTERNATE CRUISING CONDITIONS (NO RESERVE FUEL ALLOWANCE)

I (MAX. CONT. POWER) RANGE IN AIR MILES ①		II RANGE IN AIR MILES		III RANGE IN AIR MILES		FUEL (U.S. GALS) (NOTE ③)	IV RANGE IN AIR MILES		V RANGE IN AIR MILES		VI (MAX. RANGE) RANGE IN AIR MILES	
STATUTE	NAUTICAL	STATUTE	NAUTICAL	STATUTE	NAUTICAL		STATUTE	NAUTICAL	STATUTE	NAUTICAL	STATUTE	NAUTICAL
370	320	550	470	640	560	170	730	640	820	710	920	800
320	280	480	420	560	490	150	650	560	720	630	810	700
280	240	420	360	490	420	130	560	480	630	540	700	610
240	210	350	310	410	360	110	470	410	530	460	590	510
190	170	290	250	340	290	90	390	330	430	380	480	420
150	130	220	190	260	230	70	300	260	340	290	380	320
110	90	160	140	190	160	50	210	190	240	210	270	230
60	50	90	80	110	90	30	130	110	140	120	160	140
20	20	30	30	40	30	10	40	40	50	40	50	40

OPERATING DATA ②					OPERATING DATA ②					OPERATING DATA ②					DENSITY ALT. (IN FEET)	OPERATING DATA ②					OPERATING DATA ②					OPERATING DATA ②				
R.P.M.	M.P. (IN. HG)	T.A.S. (M.P.H.)	T.A.S. (KNOTS)	G.P.H.	R.P.M.	I.A.S. (M.P.H.)	I.A.S. (KNOTS)	M.P. (IN. HG)	G.P.H.	R.P.M.	I.A.S. (M.P.H.)	I.A.S. (KNOTS)	M.P. (IN. HG)	G.P.H.		R.P.M.	I.A.S. (M.P.H.)	I.A.S. (KNOTS)	M.P. (IN. HG)	G.P.H.	R.P.M.	I.A.S. (M.P.H.)	I.A.S. (KNOTS)	M.P. (IN. HG)	G.P.H.	R.P.M.	I.A.S. (M.P.H.)	I.A.S (KNOTS)	M.P. (IN. HG)	G.P.H.
															30000															
															25000															
															20000															
2600	F.T.	285	250	64											15000	2600	225	195	F.T.	64	2400	215	185	F.T.	58	2050	190	165	F.T.	45
2600	F.T.	290	250	71						2600	240	210	F.T.	71	12000	2500	235	205	F.T.	65	2300	225	195	F.T.	57	1950	195	170	F.T.	44
2600	F.T.	295	255	84	2600	255	220	F.T.	84	2500	250	215	F.T.	78	9000	2400	240	210	F.T.	65	2250	225	195	29.5	54	1850	200	175	F.T.	43
2600	38.5	297	260	136	2450	255	220	F.T.	90	2350	250	215	33.5	74	6000	2300	240	210	32	62	2100	220	190	30	51	1700	190	165	28.5	40
2600	38.5	285	250	120	2450	255	220	F.T.	87	2350	250	215	34.5	71	3000	2300	240	210	32.5	59	2050	220	190	30.5	49					
2600	38.5	275	240	105	2450	260	225	36.5	83	2350	250	215	34.5	68	S.L.	2250	240	210	32	56	1950	220	190	31.5	47					

① RANGE VALUES AT 6000 FT. ALTITUDE ONLY

② REFER TO PGS. 36 FOR ADDITIONAL ENGINE DATA

③ ALLOW 10 GALS. FOR WARM UP, TAKE-OFF, & CLIMB TO 5000 FEET ALTITUDE.

HEAVY NUMBERS: USE AUTO-RICH.

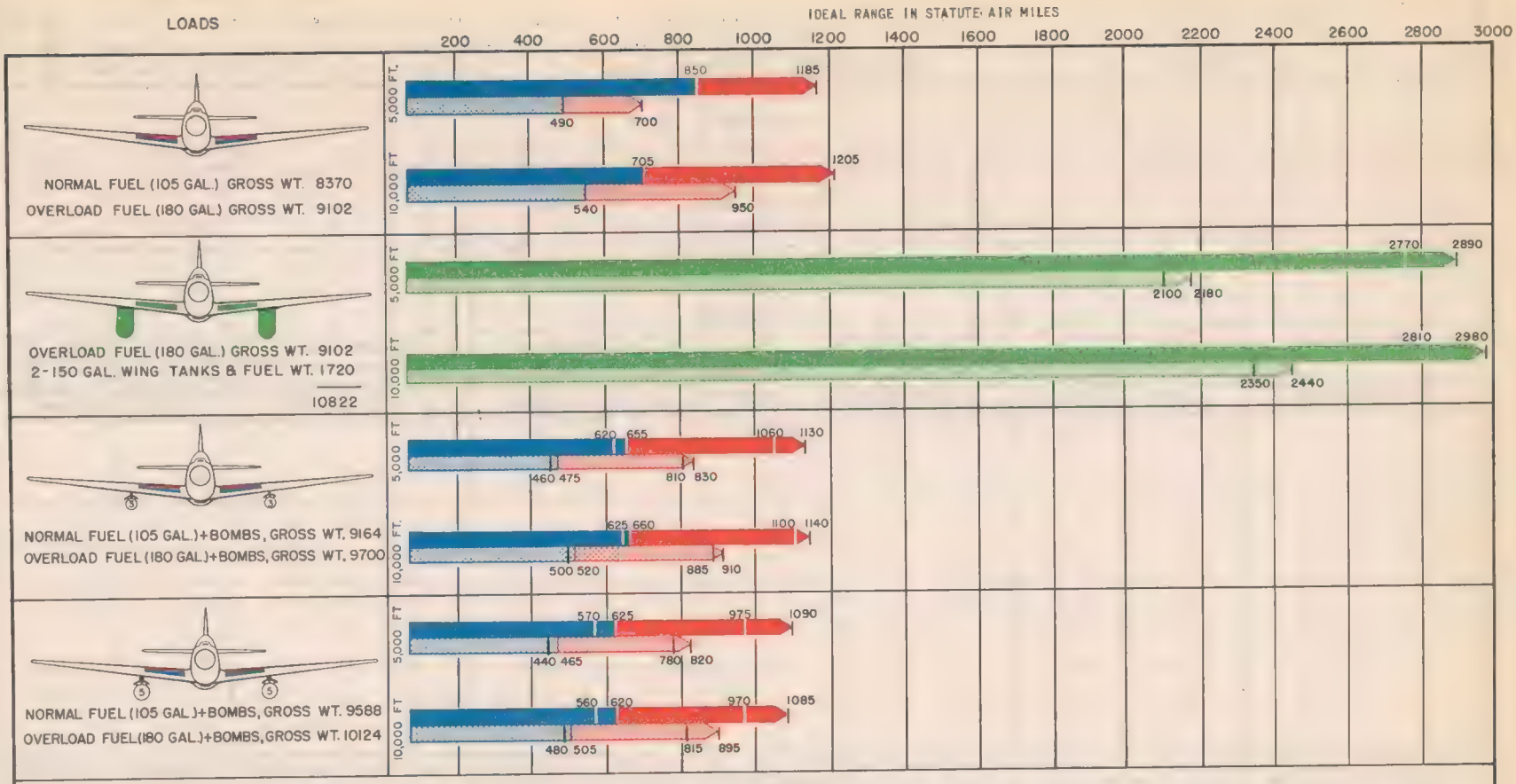
LIGHT NUMBERS: USE AUTO-LEAN.

WITH TWO SPEED BLOWER: USE HIGH BLOWER ABOVE HEAVY LINE ONLY.

I.A.S. : INDICATED AIR SPEED
T.A.S. : TRUE AIR SPEED
M.P. : MANIFOLD PRESSURE (IN. HG)
G.P.H. : U.S. GALLONS PER HOUR (MULTIPLY BY .833 FOR IMPERIAL GALLONS)
F.T. : FULL THROTTLE

RED FIGURES ARE PRELIMINARY: — SUBJECT TO REVISION AFTER FLIGHT CHECKED.

AUGUST 1942



LEGEND

1. NORMAL FUEL AND RANGE
2. OVERLOAD WING TANK FUEL AND ADDITIONAL RANGE
3. MAXIMUM OVERLOAD FUEL AND RANGE (WITH DROPPABLE TANKS)
4. THE TOP PAIR OF ARROWS IN EACH SECTION GIVES THE RANGE FOR THE INDICATED LOAD AT 5,000 FT; THE LOWER PAIR, AT 10,000 FT.
5. THE TOP ARROW OF EACH PAIR GIVES THE RANGE FOR THE MOST ECONOMICAL CRUISING CONDITION; AND THE BOTTOM ARROW GIVES THE RANGE FOR MAXIMUM CRUISING POWER.
6. THE TOTAL LENGTH OF EACH COLORED SECTION OF THE ARROWS GIVES THE RANGE OBTAINED WITH THE CORRESPONDING FUEL LOAD WHEN THE LOAD IS DROPPED AS FOLLOWS: THE DROPPABLE TANKS, WHEN EMPTY; THE BOMBS, AT .4 OF THE TOTAL DISTANCE.
7. THE BREAK IN EACH COLORED SECTION OF THE ARROWS GIVES THE RANGE WHEN THE DISPOSABLE LOAD IS CARRIED THE TOTAL DISTANCE

NOTE: THESE RANGES ARE FIGURED FROM TAKEOFF WITH ALLOWANCES FOR TAXIING AND RATED POWER CLIMB (2600 R.P.M.). FLIGHT AT ALTITUDE IS FIGURED FOR CONTINUOUS OPERATION OF THE ENGINE AT THE MOST ECONOMICAL CONDITIONS. SPEED FOR MAX. RANGE IS AT AN *I.A.S.* OF *180* M.P.H.

A-36A-1-NA MILITARY RANGE CHART

SECTION IV

SPECIAL OPERATIONAL EQUIPMENT

1. RADIO.

This type airplane in use in the United States may be equipped with either radio set SCR-274 or SCR-522. The radio set SCR-522 will be described in paragraph 2. of this section under the title ALTERNATE RADIO. The transmitters of radio set SCR-274 broadcast throughout the frequency range of 3.0 to 5.3 mc and the range of the three receivers is from 3.0 to 9.1 mc and 190 to 550 kc. No spare coils are required for either transmitters or receivers.

a. BEFORE STARTING ENGINE. - Before the engine is started, proceed as follows: Turn the receiver switch to the "MCW" position (modulated continuous wave) to test reception before the airplane engine is started. See that the frequency range on the dials can be swept through for the chosen position of the tuning unit pointer without encountering the stops on the unit. Plug the headphones into the jack provided under the receiver control switches. When the tubes are warm, a slight hum should be heard in the headphones indicating that the receiver is operating. Turn the volume control to the full "INCREASE" (without pitch) position. When the engine is not operating, atmospheric and electrical disturbances are usually heard only at the maximum position of the volume control. Tune in signals by rotating the tuning cranks of the control unit. As the receiver is tuned, adjust the volume control for suitable signal intensity.

b. AFTER STARTING ENGINE. - After the engine has been started, repeat the procedure already outlined and note the noise level and electrical disturbances. If, with the volume control set at maximum in any position of the tuning dial, the electrical noise in the headphones is increased, imperfect shielding of the ignition or generator system or difficulty with the voltage regulator of the charging generator is indicated. Under these conditions, only those radio signals can be satisfactorily received which are of greater intensity than the local disturbances.

c. TRANSMITTER. - With the receiver switch turned to "MCW" and the transmitter switch turned to "VOICE," plug a microphone into the jack provided under the transmitter switch and proceed as follows:

(1) Press the switch on the microphone. A click should be heard in the headphones and the antenna-current ammeter needle should deflect to a reading of at least 4.0 amperes.

(2) Talk into the microphone. Voice sidetone should be heard in the headphones and the antenna-current ammeter needle should vibrate with the modulation of the voice. If the antenna current does not vary with voice modulation, either the transmitter is not modulated, or it is improperly tuned.

(3) Push the transmitter switch to "TONE" and press the microphone switch or the key. A steady tone should be heard in the headphones and the antenna tone should increase appreciably above the value observed on "VOICE." If no increase is noted, the transmitter is improperly tuned.

(4) Push the transmitter switch to "CW" and press the microphone switch or the key. A steady tone should be heard in the headphones and the antenna current should be the same as on "VOICE."

d. MICROPHONE. - For best results when communicating from an airplane, the following rules should be followed relative to the use of a microphone:

(1) Hold the microphone close to the face, with lips just touching the surface.

(2) Keep the head in a vertical position while transmitting so that the plane of the microphone face is substantially vertical.

(3) Do not shout. Forget the surrounding noise and imagine that you are speaking directly into the ear of the listener.

(4) Finish each word completely before starting the next.

(5) Emphasize with a distinct hiss all sibilants such as "S," "C," and "Z." Emphasize all terminal consonants such as "T" and "G."

2. ALTERNATE RADIO.

a. GENERAL. - The radio set SCR-522 is optional equipment and instructions for its use are confidential. For this reason, the points discussed will be kept to a minimum. The SCR-522 transmitter-receiver broadcasts and receives throughout the frequency range of 100 to 156 mc.

NOTE

When operating the SCR-522 radio set on the ground, the time of operation should be kept to a minimum to prevent an excessive drain on the battery.

b. OPERATION. - To operate the equipment, press the button A, B, C, or D. Allow the set approximately

1 minute to warm up. For transmission, place the T-R-V.O. switch in the "T" position. Then close the microphone switch and speak into the microphone. For reception, place the T-R-V.O. switch in the "R" position. For voice operation, place the T-R-V.O. switch in the "V.O." position and close the microphone switch. Under these conditions, the receiver is normally in operation. To transmit, speak into the microphone. Since there is a slight delay when changing from reception to transmission, it is advisable to begin the message with a meaningless word like "hello." This will actuate the switching mechanism and insure that the message will be transmitted in full. To receive again, stop speaking into the microphone. To stop the equipment, press the "OFF" button. If it is desired to place the T-R-V.O. switch in any of its three positions, the locking lever must first be raised. The channel indicator lamps in the front panel of the control box may be dimmed by lowering the dimmer mask lever located just above the channel "A" indicator lamp. The dimmer masks should be lowered at night to prevent glare.

3. GUNNERY EQUIPMENT.

a. GUNS. - The airplane is equipped with six fixed .50-caliber machine guns with provisions for 200 rounds of ammunition for each gun. One synchronized fuselage gun is located under each side of the engine, and two free-firing guns are mounted in the leading edge of each wing. The fuselage guns fire parallel and are adjusted vertically so that the fire converges with the line of sight of the gun sight at 300 yards. The wing guns are adjusted horizontally and vertically so that the fire converges with the line of sight at 300 yards. To charge the fuselage guns, pull back and release the gun charging handles marked "GUN LOADING," located at the upper left and right sides of the instrument panel support; repeat if necessary. The wing guns are manually charged prior to flight. All six guns fire simultaneously. To fire the guns, lift the gun and camera safety switch, located on the armament control panel, to "GUNS AND CAMERA" and depress the trigger switch on the control stick grip. The gun heaters, one in each wing gun compartment, operate when the "HEATER" switch, located on the armament control panel, is lifted to "ON." The switch should be turned to "OFF" when firing the guns and after landing.

CAUTION

The fuselage guns should not be fired when the engine is operating at less than 1000 or more than 3000 rpm.

b. GUN SIGHTS. - An optical gun sight and auxiliary ring-and-bead sight are provided. The sights are adjusted so that the line of sight is parallel to the center line of the airplane and to the flight path of the airplane at 87 percent of maximum indicated air speed in level flight. To operate the optical gun sight lamp and to regulate the light intensity of the reticle image on the gun sight reflector, turn the gun sight rheostat, located on the right side of the pilot's switch panel, to "ON." The initial turning of the rheostat turns on the lamp and further rotating of the rheostat toward "ON" increases the light intensity. The sunscreen forward of the reflector may be swung in front of the reflector to reduce sun glare. In the event of malfunction of the optical gun sight, the auxiliary gun sight may be used. The bead sight is permanently installed on the fire wall forward of the cockpit. It is necessary to remove ring sight from the stowage clips under the right side of the instrument panel glare shield and install it in the mounting socket located on the windshield frame to the right of the rearview mirror. This is done by pulling out the spring-loaded plunger of the socket, inserting the stem of the ring sight into the socket, then releasing the plunger so that it engages with the stem and holds the sight in position.

c. GUN CAMERA. - A type N-1 gun camera is provided with the airplane. The camera is located beneath the forward end of the engine between the fuselage guns. It is sighted through a small plastic window-insert in the front of the engine cowl and adjusted to converge with the line of sight of the gun sight at 300 yards. To operate the camera simultaneously with the guns, lift the gun and camera safety switch, located on the lower left side of the instrument panel, to the "GUNS AND CAMERA" position and depress the trigger switch on the control stick grip. To operate the camera without firing the guns, place the gun and camera safety switch in the "CAMERA" position and depress the trigger switch. When through photographing, place the gun and camera safety switch in the "OFF" position.

NOTE

Should the temperature drop, the heaters in the camera body will function automatically. Therefore, it is always necessary to have the safety switch in the "OFF" position when the camera is not in use.

4. BOMBING EQUIPMENT.

a. Each wing is equipped with an external bomb rack designed to carry one 250-pound, one 300-pound, or one 500-pound bomb. The bombs are released simultaneously either manually or electrically in the safe or armed condition. The bomb control handle, located at the forward left side of the cockpit, is provided with three positions: aft - "LOCK" (locked), center - "SEL" (selective), and forward - "SALVO." To disengage the bomb control handle from either the locked or selective position, it is necessary to push down the top section of the control handle. An anti-salvo guard is provided to prevent accidental release of the bombs. The inoperative position of the bomb control handle is the locked position. To release the bombs electrically, proceed as follows:

(1) Move the bomb control handle to the selective position.

(2) Turn on the nose-arming switch, the tail-arming switch, or both.

(3) Turn on the bomb safety switch.

(4) Press the bomb release switch button on the top of the control stick grip.

b. In an emergency requiring the immediate release of the bombs or in the event the electrical bomb release control becomes inoperative, it is only necessary to hinge the antisalvo guard upward, depress the top section of the bomb control handle, and push the handle forward to "SALVO." The optical gun sight may be used as an auxiliary bomb sight. The bombs may be released when the airplane is in any attitude of flight from a 30-degree climb to a vertical dive.

CAUTION

To prevent either bomb from falling into the propeller, do not release the bombs when sideslipping more than 5 degrees in a vertical dive.

5. OXYGEN EQUIPMENT.

a. GENERAL. - Provisions have been made in the fuselage structure, aft of the radio compartment, to accommodate two type D-2 oxygen cylinders. An oxygen regulator, type A-9A, is installed at the right lower side of the instrument panel. A pressure gage in the regulator shows the system pressure. A valve operated by turning the knob on the lower part of the regulator adjusts the amount of oxygen flow. A dial on the face of the regulator indicates oxygen flow and is calibrated in terms of altitude, thereby simplifying flow adjustment. An outlet tube extends from the bottom of the regulator. This type regulator is designed for use only with the rebreather masks such as the type A-8. This is an oral-nasal mask which permits breathing through either the mouth or the nose and requires no adjustment for altitude. The small valve at the bottom of the rebreather bag is for the purpose of draining off any water which may collect in the bag. The mask is connected to the outlet by means of a low-pressure rubber tube, incorporating a bayonet-type fitting at the regulator end. Missions requiring oxygen should not be undertaken until it has been determined that the regulator registers sufficient pressure to complete the particular mission. Check the operation of the regulator by turning on the oxygen regulator valve and observing the flow gage for smooth operation of the pointer over the complete range. A properly adjusted instrument will give a full flow indication of 35 after the valve has been opened at least one-half turn. Normal full pressure of the system is 365 pounds per square inch.

DANGER

If oxygen comes in contact with oil or any material containing oil, spontaneous combustion and explosion is certain to occur. Every precaution must be observed to keep oil, grease, and all readily combustible materials well away from all oxygen apparatus. Be sure hands and clothes are clean.

b. USE. - To use the oxygen regulator, connect the low-pressure tube from the mask to the outlet. Open the regulator valve by turning the knob counterclockwise until the flow indicator needle reaches the reading which corresponds with the altitude of the airplane. When oxygen is not being drawn from the system, be sure that the valve is completely closed in order to prevent leakage from the system.

PRECAUTION

The construction of the type A-8 rebreather-type oxygen mask is of such nature that it will not stand abuse. Consequently, it is imperative that masks be properly stored or hung up in the airplane when not in use. Care should be exercised to prevent unnecessary exposure to sunlight, as this causes rapid deterioration of the rubber in the mask and in the rebreather bag.

6. PYROTECHNICS.

An automatic signal discharger is located aft of the radio equipment in the fuselage. The discharger fires signal flares through a barrel in the top of the fuselage and is controlled by a pull handle located on the lower right side of the instrument panel. The discharger holds six short signals which may be varied in color, if desired; but, if they are, the pilot must have a record of the order in which they have been inserted so he will be able to select the color which he wishes to fire. Two cables are operated by the control handle, a discharge cable, and a safety cable for restraining the firing hammer. There is a damped rate control device on the discharge cable line to retard the return of the discharge cable to prevent a premature discharge of the next signal. The discharge of a signal flare is accomplished by pulling out the handle on the pilot's instrument board while it is in the normal, or vertical, position. In order to select a specific color, reference must be made to the record of the order in which the signals were placed in the discharger; then the discharger handle must be given a quarter turn clockwise. This will operate the safety cable and restrain the firing pin. By pulling out the handle while it is in this retarded position, any signal may be bypassed in favor of another one. When the desired signal is in position, the handle is returned to the vertical position, and the signal may then be fired by pulling out on the handle, as before. The

pilot should remember, however, that, when he pulls the discharge handle, he moves the flares one position in a clockwise direction, so that he will actually fire the next flare and not the one in line with the discharge barrel.

7. AUXILIARY FUEL SYSTEM.

Provisions are made for the installation of either an auxiliary 75 U. S. (63 Imperial) gallon capacity combat fuel tank or a 150 U. S. (125 Imperial) gallon capacity ferrying fuel tank attached to each wing bomb rack. The combat tanks are to be used for special extended long-range scouting or combat missions and the ferrying tanks are to be used for ferrying purposes only, especially when long over-water flights are involved. See appendix I of this Handbook for special ferrying instructions. Both type tanks are droppable simultaneously by placing the bomb control handle, located at the left side of the cockpit, in the "SALVO" position. An alternate means of releasing the tanks is provided by setting the bomb control in the "SELECTIVE" position and pressing the bomb release button at the top of the pilot's control stick. When auxiliary tanks are installed, fuel from these tanks shall be used when cruising flight is established. A separate selector valve control is provided for the auxiliary tanks and it is located on a pedestal to the right and forward of the control stick; refer to section II for instructions pertinent to its operation. Fuel gages are not provided for the auxiliary tanks.

IMPORTANT

In case a forced landing on water is necessary, tanks should be dropped prior to landing if time permits and, therefore, they should not be used for flotation purposes.

APPENDIX I

SPECIAL FERRYING INSTRUCTIONS

1. FUEL SYSTEM.

a. DESCRIPTION.

(1) GENERAL.

(a) By the addition of two separate auxiliary tanks, the total fuel capacity of certain A-36A-1-NA fighter divebombers has been increased to 480 U. S. (400 Imperial) gallons. The basic fuel system has not been changed, as the additional tanks, which are droppable, are secured to the airplane by means of the wing bomb racks and are merely attached to fuel lines already provided. The auxiliary fuel system interconnects to the main fuel system just aft of the fuel strainer on the fire wall. The tanks, lines, and units of the fuel system have been prepared for the use of aromatic fuels. For a line diagram of the complete fuel system, on which fuel capacities are tabulated, see figure 15.

(b) The complete fuel system, including the main and auxiliary systems, consists essentially of the following units:

UNIT	LOCATION
Main Fuel Tanks (2)	One in each wing
Selective Sump Valves (2)	Between two main tanks in centersection of wing
Selector Valves (2)	Inside of right and left wheel recesses
Strainer	Right side of fire wall - bottom
Booster Pump	Left side of fire wall - bottom
Fuel Pump	Aft end of engine
Drain Box	Lower aft end of engine
Ferrying Tanks (2)	Bottom of wing - outboard

(c) The engine is supplied with fuel from the two main, self-sealing tanks in the wings and from the auxiliary tanks when they are installed. The regular fuel flow is from the main tanks, through the selective sump valve to the selector valve, through the fuel strainer and booster pump and on to the engine fuel pump and carburetor. The auxiliary tanks consist of droppable ferrying tanks, one mounted on each bomb rack. The fuel from the auxiliary tanks passes through the auxiliary system selector valve to the main fuel lines. The main fuel lines are of the self-sealing type, and aluminum tube lining is used at critical bends. The tanks are not interconnected, and it is necessary to switch from one tank to the other and then to the reserve to provide smooth operation of the engine. To ensure a sufficient fuel supply to the engine during steep climbs or dives, two outlet lines, which are interconnected by a selective sump ball-and-socket valve to a single pipe, are provided at the forward and aft end of each tank. A partition or bulkhead, running fore and aft, is built integral with the interior of each tank structure just outboard of the tank sump. Check valves in this bulkhead trap fuel in the inboard side of the tank to ensure an adequate supply of fuel to the engine at all times during maneuvers. The carburetor is of the fuel injection type, incorporating an idle cut-off device, and is equipped with a vapor return line that extends to the left main fuel tank.

(2) MAIN FUEL TANKS. - Each main tank has a total capacity of 90 U. S. (75 Imperial) gallons, but the tank in the left wing is divided into main and reserve supplies. Small holes are provided in the extreme lower portion of the stiffening baffles to permit fuel to flow toward the sump when the tank is nearly empty. A magnetic-type fuel gage, mounted on each tank, extends into the sump compartment. Each tank is provided with a long vent line extending into the fuselage and having its outlet at the wing fillet. The capacity shall be marked on the filler caps.

(3) FERRYING TANKS. - The droppable ferrying tanks are constructed of wood and have a fuel capacity of 150 U. S. (125 Imperial) gallons each. When carried, they are installed on the bomb racks by means of U-bolts. The metal fuel lines are connected to a nipple which protrudes from the under side of the wing. Access to the feed line within the tank is gained by the removal of the access door at the top of the tank. A vent line extends along the top of the tank, from front to back.

(4) BOOSTER PUMP. - The electric booster pump for the fuel system is located on the bottom left-hand side of the front of the fire wall. With the ignition switch turned "ON," the booster pump may be controlled by the booster pump switch on the right side of the pilot's switch panel. The booster pump may be used for either the main fuel system or the auxiliary fuel system by adjustment of the selector valve controls.

(5) FUEL PUMP. - An engine-driven fuel pump is mounted on the aft end of the engine. When the engine is being started, this pump is assisted by the booster pump.

(6) SELECTOR VALVES. - Two fuel selector valves, one located in each wheel recess, are provided for control of the main fuel system and the auxiliary fuel system. The valves are manually operated by control handles located side by side on the floor, directly underneath the switch panel.

(7) ENGINE PRIMER SYSTEM.

(a) CONTROLS. - An engine primer pump and operating handle are installed on the subpanel at the lower right side of the instrument panel. When priming operations are completed, make certain the handle is pushed in and turned clockwise to the "OFF" position.

(b) DISTRIBUTOR. - The distributor valve is mounted on top of the engine, forward of the carburetor. Four lines, 1/16 inch in diameter, run from the distributor to the forward and aft ends of the intake manifolds.

(8) CARBURETOR. - The carburetor is a Stromberg, Type PD-12K7, and is mounted on the aft end of the engine.

b. OPERATION.

(1) TAKE-OFF. - Turn the main fuel system selector valve to the "RESERVE" position and the auxiliary fuel system selector valve to the "OFF" position. Desired fuel valve settings should always be determined by CLICK and FEEL, and not solely by dependence upon the position of the control handle pointers. Be sure the booster pump is "ON" and operating properly.

WARNING

DO NOT lower the flaps over 20 degrees when the droppable ferrying tanks are installed, as serious structural damage to the airplane would follow. Neither the tanks nor the flaps are designed to withstand the hydraulic pressure that would be placed upon them if an attempt were made to lower the flaps fully.

(2) IN FLIGHT. - Turn the fuel selector valve from "RESERVE" to the "OFF" position and quickly turn ON either the LEFT or RIGHT auxiliary system selector valve. Alternate between both ferrying tanks in consuming the fuel, to prevent excessive wing heaviness. When the entire auxiliary supply of fuel has been consumed, turn the auxiliary selector valve to the "OFF" position, and turn the main fuel system selector valve to the "LEFT" position. Then continue to alternate between the LEFT and RIGHT main tanks until all of the fuel has been consumed, at which time the RESERVE supply of 32 U. S. (27 Imperial) gallons will be available.

(3) LANDING. - When landing, turn the main fuel system selector valve to the "RESERVE" position. Be sure the booster pump is "ON."

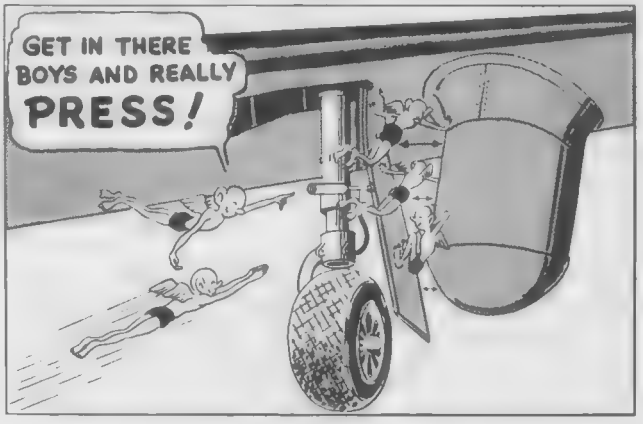
WARNING

Ascertain at all times that one selector valve is "OFF" when the other is in the "ON" position. The engine will not function if either selector valve is set to an empty tank.

(4) IMPORTANT NOTES FOR PILOT.

(a) AUXILIARY FUEL SUPPLY. - The pilot must keep in mind that it requires approximately 10 SECONDS for the fuel from the second ferrying tank to reach the engine after the fuel from the tank first used has been depleted.

(b) RAISING THE LANDING GEAR. - Test flights have brought to light the fact that an unusual condition exists when the landing gear of the A-36A-1-NA airplane, equipped with long-range ferrying tanks, is raised or lowered. With the gear in the down position, the air flow between the landing gear and the ferrying tanks creates a side pressure of enough force to result in the binding of the landing gear down-lock pin. Therefore, to retract the landing gear under these conditions, the pilot must first pull up on the landing gear handle and then YAW THE AIRPLANE FROM SIDE TO SIDE IN ORDER TO RELIEVE THIS AIR PRESSURE SUFFICIENTLY TO PERMIT THE DOWN-LOCK PIN TO BE RELEASED.



(c) LOWERING THE LANDING GEAR. - Also as a result of thorough flight tests it has been discovered that when the landing gear has been dropped, side pressure between the landing gear fairing and the ferrying tanks will prevent the gear from fully lowering into the required position to enable the down-lock pin to engage. Therefore, to lower the landing gear under these conditions, the pilot must first push down on the landing gear handle and then YAW THE AIRPLANE FROM SIDE TO SIDE UNTIL THE DOWN-LOCK PINS ARE ENGAGED.

c. INSTALLATION OF FERRYING TANKS. - Before installing the tank, adhere to the preinstallation inspection procedure outlined below.

(1) Check bomb release racks for proper operation.

(2) Ascertain that the standpipe is installed in the tank properly. This inspection is accomplished by removing the small door on the forward end of the tank.

(3) Make sure that all fuel has been drained from the tank.

(4) The letters A, B, C, etc., preceding each instruction item below correspond to those shown in figure 16.

A. Ascertain that the bomb rack is properly installed and that the airplane is on level ground. After this is done, station a man in the cockpit to hold the bomb control handle in the "SALVO" position until the support hooks are opened. Then set the bomb release control in the "SEL." position, allowing the suspension hooks to remain open.

B. Install the vent line on the tank.

C. Make sure that the aft section fairing is installed properly. Check for proper movement of the fairing.

D. See that the tension spring is installed properly.

E. Install the two sway bolts, and screw them in slightly more than halfway. Clean and lubricate the bolts if necessary to enable them to be turned by hand.

F. Install two rear studs, and screw them in slightly more than halfway. Clean and lubricate if necessary.

G. Install the flexible line to the ferrying tank. Apply light grease, Specification No. VV-L-791-2, to the nipple located in the wing and then make the connection with the loose end of the flexible hose.

H. Two or three men can now lift the tank into place in the wing bomb rack.

I. With a sudden force, insert the suspension U-bolts into the suspension hooks on the bomb racks; this will move the suspension hooks to the closed position. Place the bomb control handle in the "LOCK" position.

NOTE

Adjust the sway bolts to the proper length to rigidly support the tank. Make sure that bolts are finger tight.

IMPORTANT

Do not use a wrench. By finger-tightening the bolts, the tank will automatically assume the proper position. Tighten the lock nut on each sway bolt.

J. Make certain that the plug on the bottom of the tank is installed, and then fill the tank to the proper capacity of 150 U. S. (125 Imperial) gallons.

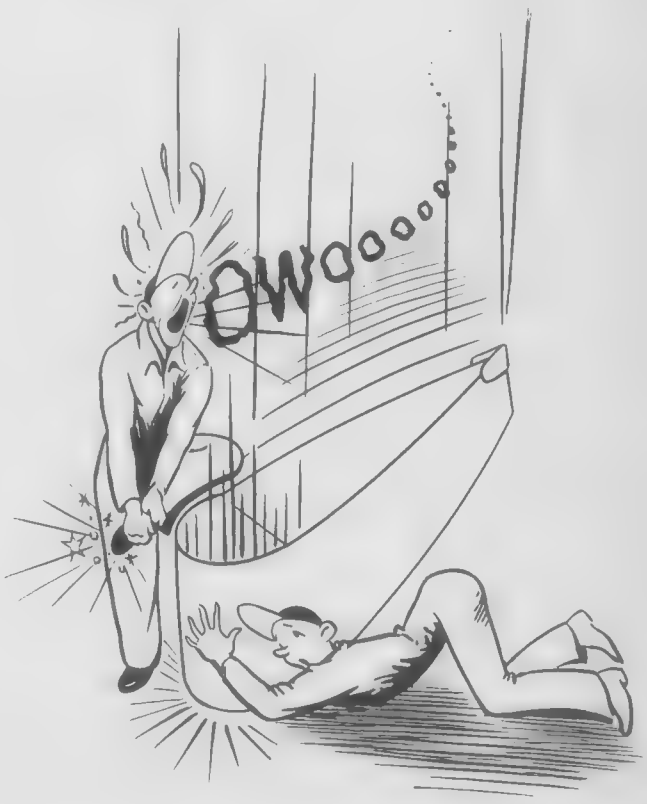
K. Install the filler-neck cap, drain a slight amount of fuel from the tank, and safety the plug at the bottom.

L. After the tank is installed and serviced, install the wing fairing around the tank, making sure that the fairing has felt running around the top edge. The felt must be installed on the flexible aft section of the fairing (C) to prevent wearing of the flap when in contact with the fairing. Install the nuts on the forward fairing tension bolts and draw them up tight. When this is done, install the side plates on both sides of the tank, using the proper number of screws.

d. REMOVAL OF FERRYING TANKS. - When removing the droppable tank while the airplane is on the ground, have available a rack or stand or some other means of support for the tank. Three men are required to remove the droppable tank, one at the bomb release control and two to hold the tank when it drops. The tank is released by placing the bomb release control handle in the "SALVO" position, or by placing the control handle in the "SEL." position and pressing the bomb release button on the top of the pilot's control stick.

NOTE

Be sure all fuel has been drained from the tank before removal.



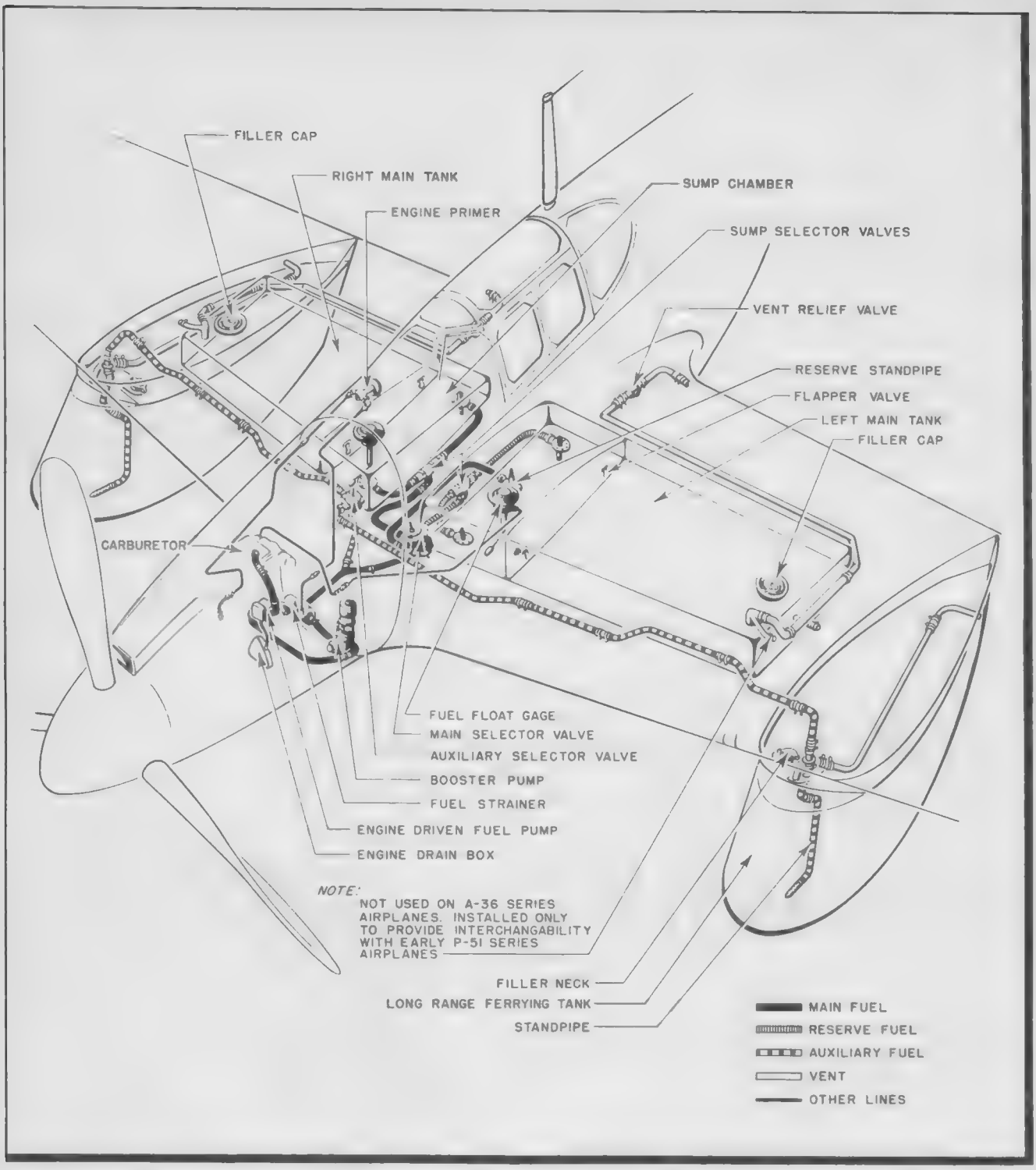


Figure 14 - Fuel System Diagram

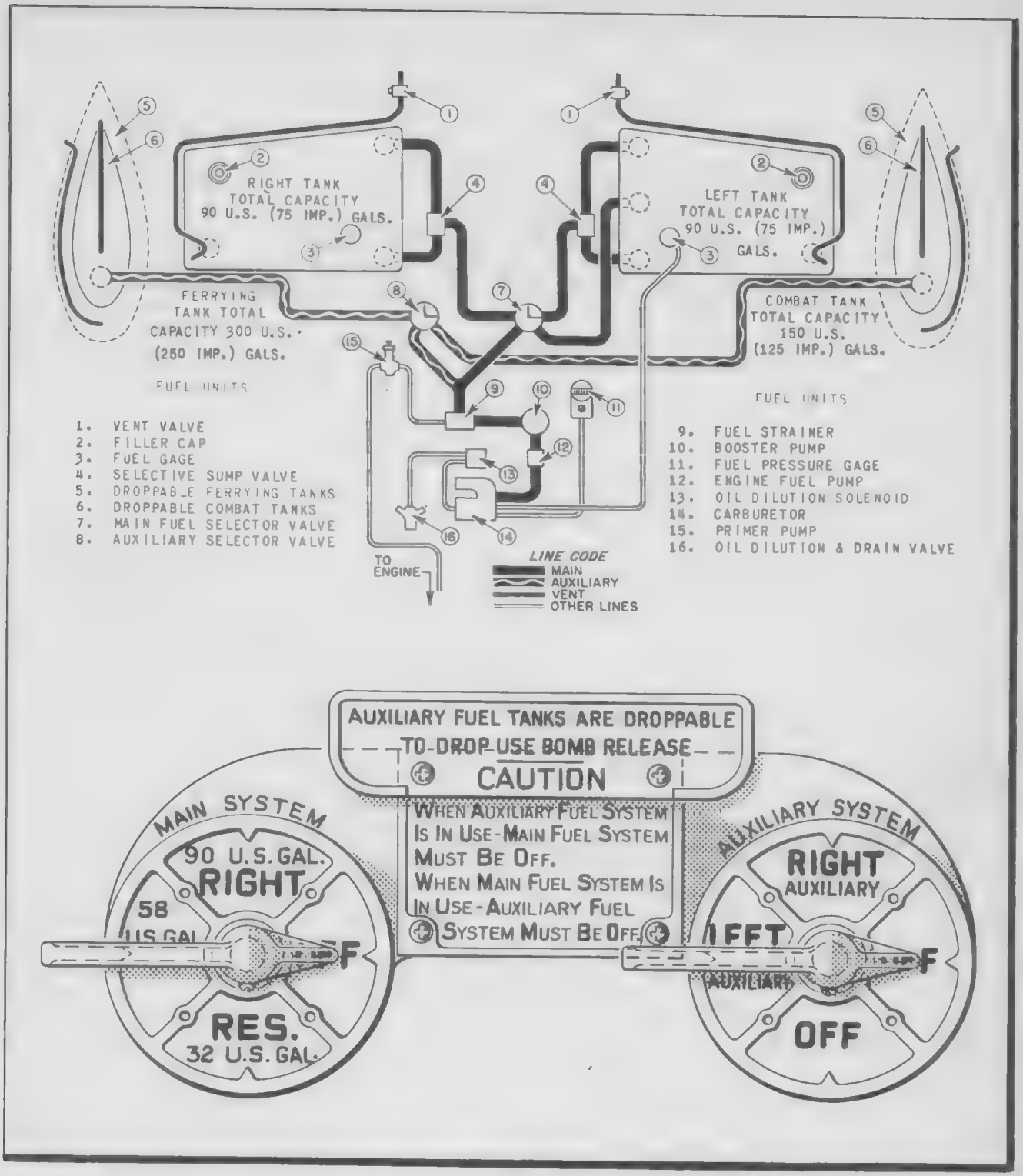


Figure 15 - Fuel System Line Diagram

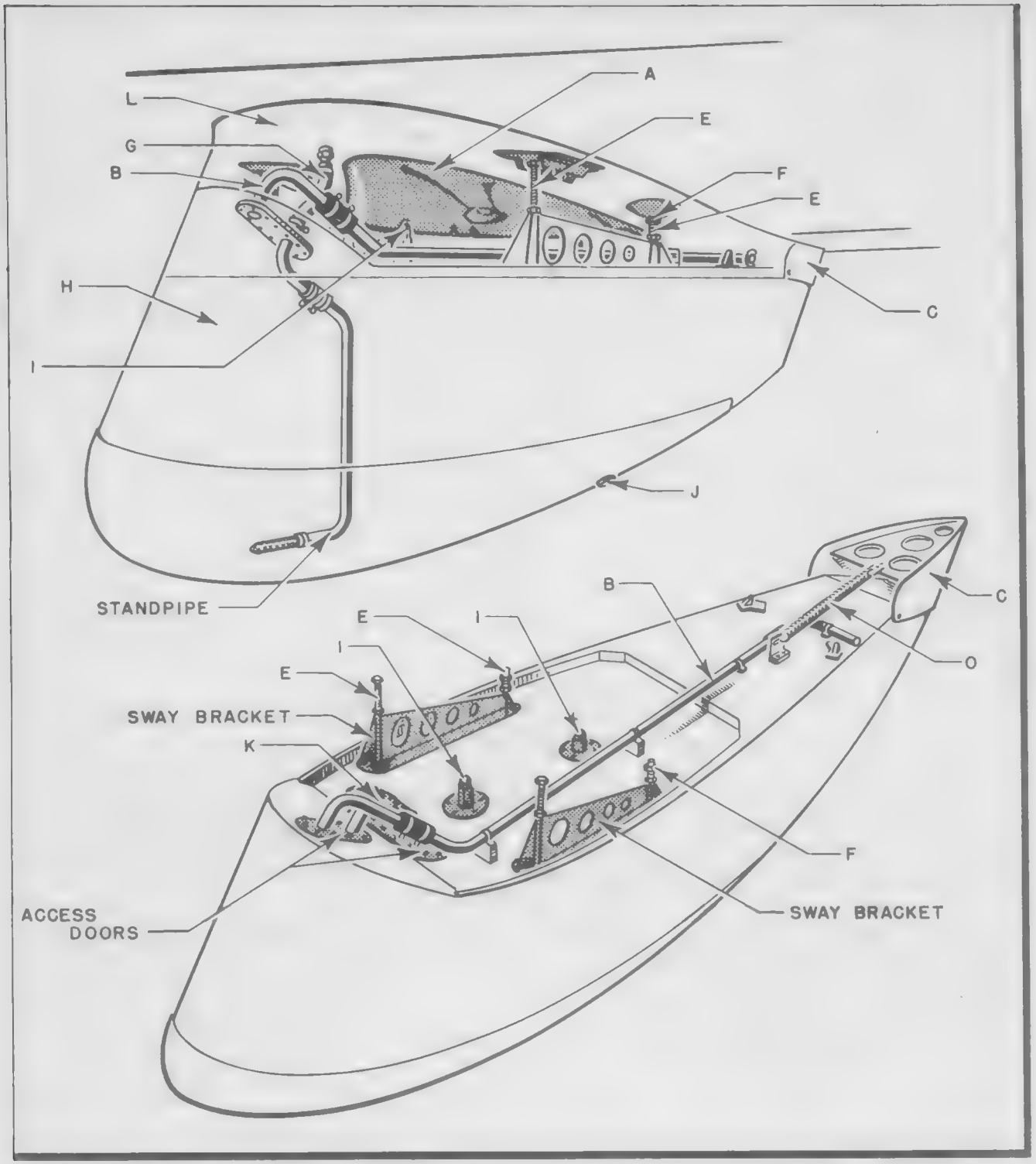


Figure 16 - Ferrying Tank Installation Diagram

2. LOOSE EQUIPMENT.

When loaded for ferrying as shown below, the airplane will have take-off horizontal center of gravity (wheels down) at 26.6 percent M.A.C. With all fuel consumed and ferrying tanks dropped, the horizontal center of gravity (wheels down) will be at 23.0 percent M.A.C. The items listed are to be loaded in the airplane for longrange ferrying and should be stowed as follows:

a. GENERAL LOADING.

	WEIGHT POUNDS
Nominal Weight Empty (Including Normal Radio Equipment)	6650
Pilot and Parachute	200
Fuel - 180 U.S. (150 Imperial) gallons in wing tanks	1080
- 300 U.S. (250 Imperial) gallons in droppable tanks	1800
Oil - System and tank full	133
Armament - 2 nose guns and accessories	136
- 4 wing guns and accessories	278
- 1 optical gun sight	4
- 2 wing bomb racks	26
- 6 pyrotechnic signals	4
Pilot's Seat Armor Plate	76
Droppable Fuel Tanks Installation	235

b. Special stowage provisions are built into the airplane for the following items:

	WEIGHT POUNDS
1 Mooring Kit	11
1 First-aid Kit	1
1 British Battery Cart Adapter	1
1 Water Container	1

c. The following items are stowed in the nose ammunition boxes and in the ejected-link-and-case container:

	WEIGHT POUNDS
1 Engine and Cockpit Cover	16
1 Set Of Dust Excluders	9

d. The following items are stowed in the wing ammunition boxes:

	WEIGHT POUNDS
1 Engine Hoisting Sling	5
2 Airplane Hoist Rings	2
1 Set Propeller Tools (Curtiss)	19
1 Kit - Engine tools (Allison)	7
1 Kit - NAA special tools and jacking screws	4
2 Wing Gun Charging Hooks	1
2 Oil Cooler Shields	1
Miscellaneous Spare Parts per NAA Service Order No. 1495	30
Gun Camera in Case - Stowed in radio compartment	11
Instruction Books and Diagrams - Stowed in data case	5
Carburetor Air Filter Panel - Lashed onto bottom of sliding radio shelf	14
TOTAL - FERRYING GROSS WEIGHT	10,760

e. The above summary does not include the de-icing equipment which is listed below:

	WEIGHT POUNDS
Wing and Tail De-icer Shoes Installation, Including Accessories and Controls	51
Carburetor and Propeller De-icing Equipment, Installation, Including 8 U.S. (6.7 Imperial) Gallons Fluid for Carburetor and 2 U.S. (1.7 Imperial) Gallons Fluid for Propeller	93

NOTE

If the de-icer equipment is installed, the range data included in the chart section of this book must be corrected.

3. SERVICING.

a. FUEL SYSTEM.

(1) FILLING MAIN FUEL TANKS. - Before filling the main fuel tanks, make a general examination of the fuel system for obvious leaks. Drain a small amount of fuel from the tanks by means of the drain cocks, two located at the forward end of the radiator scoop and one in the fuel strainer at the bottom of the fire wall.

CAUTION

The airplane must be grounded before filling the tanks.

The two main fuel tanks are filled individually through the filler necks provided on the upper surface of the respective wing sections. For maximum fuel capacity, fill the tanks to a capacity of 180 U.S. (150 Imperial) gallons. The fuel gages are accurate only when the airplane is in the level flight position. Replenish the fuel tanks when necessary and see that the filler caps are properly secured. The fuel to be used is 100 octane in accordance with Specification No. AN-VV-F-781.

(2) FILLING FERRYING TANKS. - Fill ferrying tanks to overflowing 150 U.S. (125 Imperial) gallons

at the filler neck between the leading edge of the wing and tank. No gages or drain cocks are provided.

b. OIL SYSTEM. - Access to the oil filler neck is gained by means of a small Dzus-fastened door on the left side of the upper engine cowling. The full capacity of the oil system is 18 U.S. (15 Imperial) gallons, Specification No. AN-VV-O-446, grade 1120. In replenishing the tank when foam is present, care should be exercised to ensure a proper reading of the oil level. If for any reason the oil system has previously been drained, fill the oil tank to overflowing; this will require approximately 12 to 13 U.S. (10 to 10.8 Imperial) gallons. Run the engine for 1 or 2 minutes at between 1000 and 1200 rpm. These figures should be closely adhered to, as running the engine above the specified time or speed could cause serious internal damage to the engine. Stop the engine and again fill the tank to overflowing. Approximately 5 U.S. (4.2 Imperial) gallons more oil should be required to fill the system to capacity. Tighten and safety the filler cap, wipe off any spilled oil, and replace the access door.

c. COOLANT SYSTEM. - Access to the coolant tanks is gained by means of a Dzus-fastened door on left side of the engine nose cowling directly aft of the propeller spinner. When replenishing, fill slowly to overflowing capacity. If the system is dry, fill with a measured amount of 21 U.S. (17.5 Imperial) gallons, AAF Specification No. 1410B. The system will not take the full 21 gallons on first filling and it will be necessary to run up the engine for not more than 2 to 3 minutes. Running the engine any longer will tend only to cause the coolant liquid to foam, thus preventing the addition of the remainder of the coolant liquid required to fill the system to full capacity. Stop the engine and add the remaining fluid. Tighten and safety the filler plug, wipe off any liquid spilled during filling, and secure the access door.

d. HYDRAULIC SYSTEM.

(1) FILLING SYSTEM. - The total capacity of the hydraulic system for this airplane is approximately 4.25 U.S. (3.54 Imperial) gallons. The fluid used in the hydraulic system is a mineral oil with a petroleum base, Specification No. AN-VVO-366A (red fluid). In handling the hydraulic oil, every precaution must be taken to prevent its contamination. The storage containers must be kept sealed. All handling equipment must be kept clean and should be used only for handling hydraulic fluid. Do not expose hydraulic oil to the air for periods longer than is absolutely necessary, as the oil will absorb dust and grit from the air, and in certain localities, this becomes a serious menace. Fluid that has been exposed to dust and grit, or has been in use previously, should be filtered to remove sludge, metal flakes, and grit, before using. The simplest equipment for filtering hydraulic oil consists of a ribbed glass or metal funnel of approximately 1-gallon capacity, a sheet of commercial filter paper, and a container to support the funnel and hold the filtered oil. The filter paper is folded into a funnel shape and placed in the funnel. The filtered oil should be placed in clean containers properly marked to identify the contents, and should be kept sealed until required for use.

(2) REFILLING RESERVOIR. - Exhaust the system pressure and fill the reservoir to overflowing with hydraulic oil. The reservoir fluid capacity is 1.74 U.S. (1.45 Imperial) gallons. Access to the reservoir filler neck is readily gained by removing the Dzus-fastened cover plate immediately forward of the cockpit windshield. When filling the reservoir, it is recommended that a suitable receptacle be placed under the reservoir drain line which bottoms at the lower left center of the fire wall. Clean the reservoir filler neck strainer at each refilling and make sure the filler cap and dip stick are correctly secured in place.

e. CARBURETOR ANTI-ICER SYSTEM.

(1) On airplanes, serial numbers 42-83663 to 42-83857 inclusive, the carburetor anti-icing system reservoir is located aft and below the pilot's seat. The tank holds approximately 1 U.S. (0.8 Imperial) gallon of anti-icer fluid and should be filled to capacity

(2) On airplanes, serial numbers 42-83804 and subsequent, the carburetor anti-icing system reservoir is a temporary tank located in the right-hand wing ammunition box. The tank has a capacity of 8 U.S. (6.7 Imperial) gallons and should be filled with alcohol, AAF Specification No. 14082-A.

4. PREFLIGHT INSPECTION AND ENGINE RUN-UP.

The following inspection should be made prior to a long-range flight:

Check the cable tensions with the airplane out of the sun, when the temperature is at ($70^{\circ} \pm 5^{\circ}$F), ($21^{\circ} \pm 3^{\circ}$C to the following cable loads. A tension tolerance of plus or minus 5 pounds is permissible.

Rudder Cable	60 lb
Elevator Cable	70 lb
Aileron Cable	70 lb
All Trim Tab Cables	20 lb (no slack)

Inspect the turnbuckles to see that they are properly secured. Turnbuckles are considered to be in safety if not more than three threads are exposed on either end.

Inspect the fuel lines and units for leaks, general condition, and security of attachment.

Inspect the auxiliary ferry tanks for security of attachment and stability. Ascertain that the tank fillets are secure.

Inspect the oil lines and units for leaks, general condition, and security of attachment.

Inspect the coolant lines and units for leaks, general condition, and security of attachment.

Inspect the hydraulic lines and units for leaks, general condition, and security of attachment.

Turn the hydraulic purolator handle clockwise one or more complete revolutions.

Inspect the carburetor anti-icer system for leaks, general condition, and security of attachment.

Inspect the main shock struts, lock mechanism, and the wheel well for cleanliness.

Examine the tail wheel unit, lock mechanism, and entire tail wheel compartment for cleanliness.

Ascertain that the pitot tube sock has been removed, and that the air inlet hole is open.

See that the upper surface of the wing, particularly at the leading edge, is cleaned of all dirt, fuel, and oil. This is a necessary precaution to prevent premature stalling.

Inspect the drinking water containers and ration containers for security, and see that they are correctly filled.

Examine the contents of the first-aid kit for completeness and see that it is correctly stowed.

See that the automatic signal device is properly loaded.

Inspect the entire pilot's compartment for cleanliness and security of all parts. See that there are no loose objects which might foul the control cables or control rods.

Ascertain that the locking gear is secure in the unlocked (forward) position.

Operate the aileron, elevator, and rudder trim tab controls at the pedestal to ensure freedom of movement.

Operate the control stick and rudder pedals to ensure full and free movement.

Make sure that the sliding sections of the cockpit enclosure operate freely and lock securely.

Close and lock the cockpit enclosure from the inside. Inspect the two latches to make sure that they latch securely. See that the four hooks on the inside of the roof of the enclosure are secure on their respective pins.

Inspect the cockpit enclosure emergency release handle and the release mechanism to ascertain that it has not been released. See that the safety wire on the release handle and the safety wires at the aft ends of the two hinge rods have not been broken.

Visually inspect the safety harness and replace it if there are any indications of defects or deterioration. Check all attaching parts and fittings for security of fastening. Inspect the latching device for free operation, and bent or damaged parts. Check the date the harness was last tested and determine, if longer than the required period, whether the harness should be replaced. Check the operation of the harness spring-loaded release and see that it engages properly when locked. Lubricate the lock mechanism as necessary.

Inspect the oxygen system for leaks. With the regulator valve closed, open the cylinder valve sufficiently for the gage to record the cylinder pressure, and then close the cylinder valve and note the drop in pressure, if any, on the pressure gage of the regulator. If a noticeable drop in pressure is apparent, denoting a leak, make sure that all line connections are tight. If, after tightening any loose connections, a leak is still present, disconnect the lines at the cylinder and connect them to a spare cylinder, the valve of which has been checked for leakage and found to be tight. Repeat the test for leakage, and if the leak is still present, remove the regulator from the airplane and mount it directly upon a spare oxygen cylinder. Open the cylinder valve and close it again. Note any drop in pressure on the regulator gage. If leakage is apparent, replace the regulator.

Check the operation of the oxygen regulator by turning on the regulator valve and observing the flow gage for smooth operation of the pointer over the complete range. A properly adjusted instrument will give a full flow indication of 35 after the valve has been opened at least one-half turn.

Inspect the oxygen mask for general condition.

Determine whether the oxygen cylinders contain an adequate supply of oxygen to complete the intended mission. Refill as necessary.

Open the oxygen cylinder valves just prior to the start of the flight and leave them open. Be certain the regulator valves are closed. The cylinder valves should be closed upon completion of the flight.

Remove and clean the two air-speed line moisture trap sumps located in the left wheel well.

Inspect the instrument lines for leaks, tightness, flexibility, and anchorage.

Check the lamps on the instrument panel and replace any weak or broken lamps.

Inspect the instruments for correct and discernible operation markings on the cover glasses.

Check the turn indicator and the bank and turn indicator for discolored liquids and free action of the balls. A careful inspection should be made to see that there is no fluid leakage

Inspect the altimeter setting knob, pointers, and reference markers for proper operation.

Inspect the altimeter for synchronism of barometric scale and reference markers. Check for zero setting error.

Check the reading of the manifold pressure gage against the station altimeter or barometer. If the reading differs more than 0.4 inch Hg from that of station barometer, replace the instrument.

Check the pointers of the engine gage unit for tolerances. At zero, the tolerance for the fuel pressure gage is $\pm$ 0.2 pound. The tolerance for the oil pressure gage is $\pm$ 5.0 pounds. The tolerance for the thermometer is $\pm$ 3 degrees of the existing engine temperature. If excessive errors exist, replace the unit with a spare gage from stock.

Inspect the compass for dirty or discolored damping liquid, leaks, or insufficient liquid as evidenced by bubbles. Check the instrument for evidence of unbalanced card element. See that the proper compensation data is recorded on the correction card. Examine the compass for broken cover glass and damaged external parts.

See that the compass light operates properly.

Visually inspect the tachometer for indications of oil inside the cover glass.

Inspect the clock for proper winding, setting, and running operation.

Clean all the instrument cover glasses with a clean cloth.

Inspect the caging mechanism of the flight indicator and the turn indicator for correct operation.

Before the engine is started, inspect the following instruments for correct zero settings.

Bank and Turn Indicator
Air-speed Indicator
Suction Gage
Tachometer
Rate-of-Climb Indicator

Test the specific gravity of each battery cell with a hydrometer, returning the electrolyte to the cell from which removed. In case the gravity is 1.200 or lower, battery should be replaced with one fully charged.

Add distilled water to the battery when necessary, and ascertain the proper level with a self-leveling syringe.

CAUTION

Care should be taken to prevent spilling of the electrolyte from the hydrometer while taking battery readings. If any electrolyte is accidentally spilled, immediately wipe it away and wash the area with a sodium-bicarbonate solution.

Inspect the cement around the frames of the running, formation, and upper recognition lights for possible water leakage. If leakage has occured, remove the old cement and check the light sockets for corrosion.

Turn the ignition switch to "BAT." and operate the landing light switch, thereby checking the battery and the battery switching circuit.

Test the navigation lights, identification lights, cockpit lights, instrument lights, and landing lights by operating the respective switch and rheostat controls.

Ascertain that the radio equipment is in proper working order by tuning in on a station within the radio's frequency range. Check for ignition interference with the engine running.

The plate current of the radio equipment should be checked to see that excessive amperage is not being drawn by the plate circuits of the tubes.

With the transmitter in operation, the modulation should be checked by speaking into the microphone and observing the antenna current ammeter. The pointer of this meter will indicate a slight increase of current if the output is properly modulated.

The remote contactor should be checked by ensuring that during the red segment the SPECIAL channel is operating, and during the white segment the NORMAL channel is operating. The rotation time of one minute should also be checked.

See that the propeller is properly installed and all exposed screws, bolts, and pins are tight and safetied.

The exterior of all parts of the propeller should be examined for cracks, bends, nicks, and other damage. The entire leading edge, trailing edge, and tip portion of each blade should be carefully watched for development of cracks. A magnifying glass will facilitate this work. When in doubt as to the extent or seriousness of apparent cracks, aluminum-alloy blades should be given a local etching. Watch especially for longitudinal cracks.

Visually inspect the condition of all flexible conduits running to the propeller governor unit where possible damage may occur.

Visually inspect the condition and security of the propeller governor Arens controls. Inspect the cockpit control level to determine that it has at least 1/8-inch spring back from the full forward position as an assurance that the governor control is fully against the stop, which is set for take-off rpm.

Check the propeller hub and retaining nut for looseness on the shaft. If repeated tightening of the propeller hub retaining nut is necessary to maintain a proper tightness, the propeller should be removed and the cause ascertained.

Lubricate the propeller hub with lubricant, Specification No. AAF 3581-B grade AA, using a grease gun on the Zerk fitting located on the speed reducer housing just forward of the hub face, until the hub is completely filled. This will be indicated by a solid flow of grease from the relief fitting.

Check the oil level in the speed reducer. This may be done by removing the filler plug located near the front of the housing, and rotating the propeller until the plug opening is approximately 20 degrees below the horizontal plane when the airplane is at a ground angle of approximately 12 degrees and approximately 8 degrees below the horizontal plane when the airplane is level. The oil in the speed reducer should then be at the plug opening. If the oil is not at the plug opening, completely fill the gear assembly at this point using lubricant, U. S. Army Specification No. 2-27.

See that all exposed surfaces of the propeller are thoroughly coated with clean engine oil. The propeller should be washed thoroughly with fresh water and dried before coating with oil.

Inspect the propeller spinner for general condition and security of attachment.

Wash the engine completely, taking care that no cleaning fluid enters the generator, starter, or any other electrical equipment.

Drain the regulator unit, air chamber, fuel chambers, and fuel control unit of the carburetor by means of the plugs in the bottom.

Inspect the fuel intake system for broken studs. Check the lines for leaks or damage.

Check the exhaust manifolds and studs for looseness.

Remove the front and rear oil drain plugs on the engine and inspect for accumulation of sediment. Remove and clean the oil screen of the reduction gear oil pump.

Inspect the carburetor air-scoop duct for general condition and cleanliness. See that the screen in the forward end of the duct is clean.

Clean and inspect the carburetor fuel strainer, which is located on the right side of the carburetor.

Remove the screen from the end of the fuel strainer mounted on the fire wall and clean the screen with gasoline. Ascertain that the interior of the strainer is clean before installing the screen.

Remove and clean the Cuno oil strainer. Whenever the Cuno strainer is removed for cleaning, the inside of the sediment chamber will also be cleaned.

See that all drain plugs on the oil system are properly installed, tightened, and safetied.

Inspect for evidence of the engine throwing oil.

Inspect all drain plugs and access doors on the coolant system for proper installation and see that the plugs are safetied properly.

Drain a small amount of fuel from the drain cock of the fuel strainer, mounted on the fire wall, to remove any accumulated moisture and foreign matter. See that the drain cock is secure and safetied properly.

Inspect the carburetor and fuel line connections for fuel leakage, paying particular attention to drain plugs, passage plugs, and parting surfaces between the regulator castings.

Inspect all safety wiring on the carburetor for security.

Examine all throttle and mixture control rods, linkage, and bell cranks for general condition and security of attachment. See that all lock nuts are tight.

Check the fuel intake system lines for security of attachment and leaking gaskets or hose connections.

Inspect the exhaust stack flanges for security.

Inspect the high-tension ignition leads for evidence of burning as the result of leaks in the exhaust system.

Examine the engine-driven accessories for general condition and security of attachment.

Inspect the control quadrant in the cockpit for general condition and security. Check the friction control for proper functioning.

Inspect the throttle governor stop located just forward of the quadrant to see that the safety wire is not broken. A broken safety wire on the stop indicates that an excessive strain has been placed on the motor.

Check the throttle and mixture control levers at the quadrant for 1/8-inch spring back.

Check the fuel quantity gages for correct functioning and inspect for visible defects and security of attachment.

NOTE

The fuel gages are accurate only when the airplane is in the level flight position.

Operate the throttle and mixture control rods before starting the engine to see that they are free.

The engine should always be warmed up until proper lubrication and engine operation for the take-off and flight are assured.

As soon as the engine has started, the oil gage should be watched for pressure. If in 30 seconds the oil pressure gage does not indicate pressure of 60 pounds per square inch, the engine should be shut down and an investigation made to determine the cause.

Warm up the engine at approximately 1200 rpm. Check the oil temperature gage for a minimum of 20°C (68°F) and a maximum of 95°C (203°F); otherwise, continue to warm the engine until the oil temperature gage shows a definite increase and the oil pressure gage remains steady between 65 and 80 pounds per square inch when the throttle is opened. This indicates that the oil is circulating properly.

Check the radiator temperature for a minimum of 85°C (185°F) and a maximum of 125°C (257°F). Open the scoop as necessary.

During the engine warm-up, the functioning of all the tanks should be tested by switching the fuel valve to each tank for a sufficient period, to ensure that the fuel from the tank has an opportunity to flow to the engine. Proper performance of the engine during this test will ensure, as far as possible, that the entire fuel system is free from water and dirt and is functioning properly in all fuel valve positions. The fuel selector valve position must be determined by click and feel and not entirely by the settings indicated on the dial. See that the connecting linkage does not bind.

To check the constant-speed operation, place the selector switch on "AUTO" and place the governor control lever in "TAKE-OFF" position. Open the throttle until the engine turns approximately 1800 rpm and pull the governor control lever all the way back. If a reduction in rpm is noted, the control is operating. Return the control again to "TAKE-OFF" position.

Check the operation of the propeller limit switches by changing the pitch with the manual switch in both directions, until the limit switches operate.

Check for full range and free operation of the propeller controls. Do not operate the blade angle controls any more than is absolutely necessary when the engine is not running. Prolonged operating of the electric motor while the slip rings are stationary will result in excessive wear and pitting.

Check the hydraulic system by operating the flaps and the radiator air scoop. Inspect the respective indicators for indications consistent with the position of the flaps and scoop.

Check the brakes for proper operation while warming up the engine. See that the brakes do not feel spongy, indicating air in the lines, and see that the left and right pedal pressures are equal.

Inspect the fuel pressure gage to see that it maintains a pressure of 12 to 16 pounds per square inch.

With the engine operating at 1000 rpm, adjust the vacuum pump relief valve so that the suction page registers 3.75 inches Hg (minimum). Increase the rpm to the maximum rpm obtainable on the ground, and note the suction gage reading. This indication should not be more than 4.25 inches Hg (maximum). If proper adjustment cannot be made within these limits, check the suction relief valve for cleanliness of the screen, stickly valve, or loose adjustment.

During the engine warm-up period, inspect all instruments for excessive pointer oscillation.

Check all instruments for readings consistent with engine conditions.

Inspect the manifold pressure gage for a reading consistent with engine behavior. Check for excessive pressure.

With the engine turning at 1150 rpm or better, turn on the pitot heater or either of the landing lights. The ammeter should show an increase of approximately 10 amperes when this is done.

Following the engine warm-up, the throttle should be opened to the position corresponding to take-off for not over 30 seconds. Prolonged running of the engine on the ground at or near take-off throttle position should be avoided. The limits of 2300 rpm and 30 inches Hg manifold pressure for ground operation will provide a sufficient range of power and speed adequately to check the magnetos, spark plugs, and propeller control.

Check the ignition system by running the engine on each magneto separately. The loss of rpm in running on either magneto alone should not exceed 80 when the engine is warm and operating properly. A loss of over 100 rpm on either magneto generally indicates defective ignition or defective spark plugs.

Check the "OFF" position of the ignition switch to assure the proper connection of the ground wires. This check should be made at the end of the engine warm-up period with the propeller in full low-pitch and the engine turning over approximately 700 rpm. The switch should be turned to the "OFF" position momentarily to note whether or not the engine stops firing, and immediately returned to "BOTH" position. Two or three seconds is ample time for the switch to remain in the "OFF" position.

WARNING

If the engine does not cease firing when the switches are placed in the "OFF" position, it will be necessary to stop the engine by turning the fuel to "OFF." AFTER THE ENGINE STOPS, DO NOT TOUCH THE PROPELLER UNTIL THE DIFFICULTY HAS BEEN FOUND AND CORRECTED, AS THE ENGINE MAY START OR KICK OVER CAUSING DEATH OR SERIOUS INJURY.

Check all fairings, access doors, and fillets for security of attachment and general condition.

Ascertain that all loose equipment is securely stowed in its proper place.

Inspect the engine cowling panels for general condition, correct fit, and security.

With the airplane fully loaded and ready for flight, inspect the main shock absorber struts and the tail wheel shock absorber strut for proper inflation and obvious fluid leaks.

Inspect the tires for proper inflation and damage. The tires should be inflated until the deflection marks on the side walls are just in contact with the supporting surface.

Refill the fuel, oil, coolant, hydraulic and anti-icer system.

Clean the entire windshield, enclosure, and rear windows thoroughly.

5. LONG-RANGE CRUISING CHARTS.

a. GENERAL INSTRUCTIONS.

(1) The enclosed cruising charts give operational data for flight at 1000, 5000, 8000, and 10,000 feet altitudes. All the long-range cruising charts are based on a take-off gross weight of 10,820 pounds, including a capacity fuel load of 480 U.S. (400 Imperial) gallons. There are three complete sets of charts, one set each for 177, 215, and 235 mph pilot's indicated air speed. While 177 mph pilot's indicated air speed is the speed for maximum range, the other chart sets are provided so that higher speed may be maintained for shorter distances. These charts were figured for a normal power climb (2600 rpm and 38.5 inches Hg) from take-off to the desired altitude and continued flight until the fuel is entirely depleted. The fuel in the ferrying tanks should be used first; then, if the tanks are to be dropped, they should be released as soon as they are empty. When flight changes are made from one altitude to another, take the gross weight at the end of the operation at one altitude, and enter the new altitude chart with this gross weight modified slightly for climb or descent.

(2) These charts have been calculated for the airplane without the special winterization equipment, which includes wing and tail de-icer shoes and special anti-icer fluid tanks. If the de-icer equipment is installed, the range data must be corrected.

(3) Each chart shows operating conditions with the ferrying tanks installed, as indicated by solid lines, and with the ferrying tanks dropped when empty, as indicated by dashed lines. Note that the maximum range, with tanks carried all the way, is not more than 130 miles shorter than when the tanks are dropped when emptied; thus, in most cases, it will not be necessary to drop the tanks. However, when the tanks are to be dropped, it is necessary to refer to the dashed lines. The gross weight of the airplane will be 9000 pounds when the ferrying tanks are empty, and after the tanks have been dropped, the gross weight will be 8790 pounds. Thus it will be necessary to first refer to the solid lines until the tanks are empty; then, when the tanks have been dropped, refer to the dashed lines to obtain the correct data.

b. CRUISING CHARTS - VARIOUS ALTITUDES. (See figures 17, 22, and 27.)

(1) To obtain engine operating conditions for any gross weight, project vertically up to the groups of curves and read the engine operating conditions at the desired flight altitude.

EXAMPLE
(See figure 17.)

With a gross weight of 9800 pounds and an altitude of 8000 feet, find the engine operating conditions for maximum range as follows: Project vertically upward from 9800 pounds on the bottom scale to the 8000-foot altitude curve in each of the three groups. At these three intersections proceed horizontally to read 1620 rmp, 26 inches Hg manifold pressure, and a fuel flow of 35 U.S. (29 Imperial) gallons per hour. The weight reduction per hour is calculated by multiplying the number of gallons per hour by six. This gives a fuel flow of 210 pounds per hour. If atmospheric conditions are not close to standard, it may be necessary to change both the manifold pressure and rpm slightly in order to obtain the desired pilot's air-speed reading of 177 mph. This reading should be kept nearly constant throughout the flight.

(2) If the gross weight at take-off differs from 10,820 pounds by more than 200 pounds, a new chart may be obtained in the following manner: For a conservative figure, assume that the weight at the desired altitude for flight will be the same as that at take-off. With this weight, use the chart to obtain the operating conditions for the first hour. The gross weight for the second hour will be the take-off gross weight less the fuel used. With this new gross weight, obtain the operating conditions for the second hour. Proceed in this same manner for each successive hour.

EXAMPLE
(See figure 17.)

Let the take-off gross weight be 10,400 pounds and a desired pilot's indicated air speed of 177 mph at an altitude of 10,000 feet. From the chart obtain 1700 rpm, full throttle (25.8 inches Hg manifold pressure), and 37 U.S. (31 Imperial) gallons per hour fuel flow as the first hour's operating condition. The gross weight for the second hour will be 10,400 pounds less 6 x 37, or 10,180 pounds. With this new weight obtain 1680 rpm, full throttle (25.6 inches Hg manifold pressure), and 36 U.S. (30 Imperial) gallons per hour fuel flow for the second hour. Follow the same procedure for the succeeding hours. The range is obtained from the product of true speed and hours of flight.

c. CRUISING CHARTS - INDIVIDUAL ALTITUDES
(See figures 18 to 21, 23 to 26, and 28 to 31.)

(1) This data is for use at one altitude for the speeds tabulated at the bottom of the chart and a take-off gross weight of 10,820 pounds. In using these charts, project horizontally from the hours-used scale to the hours curve. From this intersection, project vertically to obtain the desired data.

EXAMPLE
(See figure 20.)

The flight is being made at 8000 feet and 7 hours have passed. The gross weight at this time is 9210 pounds, and the engine settings are 1610 rpm and 25.5 inches Hg boost. If this setting does not give the desired air speed, increase or decrease the rpm and manifold pressure along the curve. At this rpm and manifold pressure, the fuel flow will be 33.3 U.S. (27.8 Imperial) gallons per hour or 200 pounds per hour. The distance covered is 1420 miles, and the available range remaining is 1400 miles (2820 minus 1420) if the tanks are carried all the way, or 1520 miles (2940 minus 1420) if the tanks are dropped when empty.

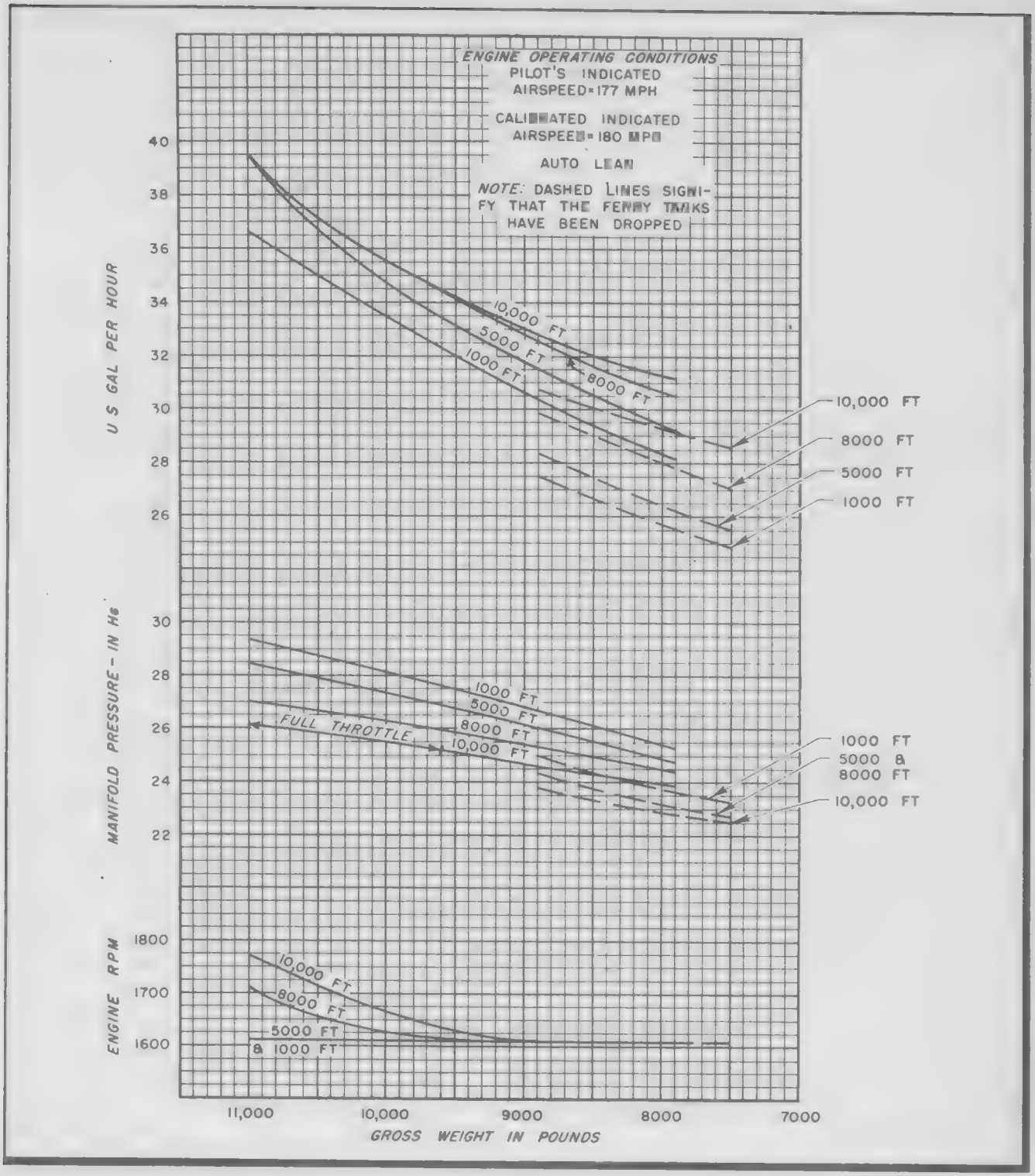


Figure 17 - Long-Range Cruising Chart - All Altitudes

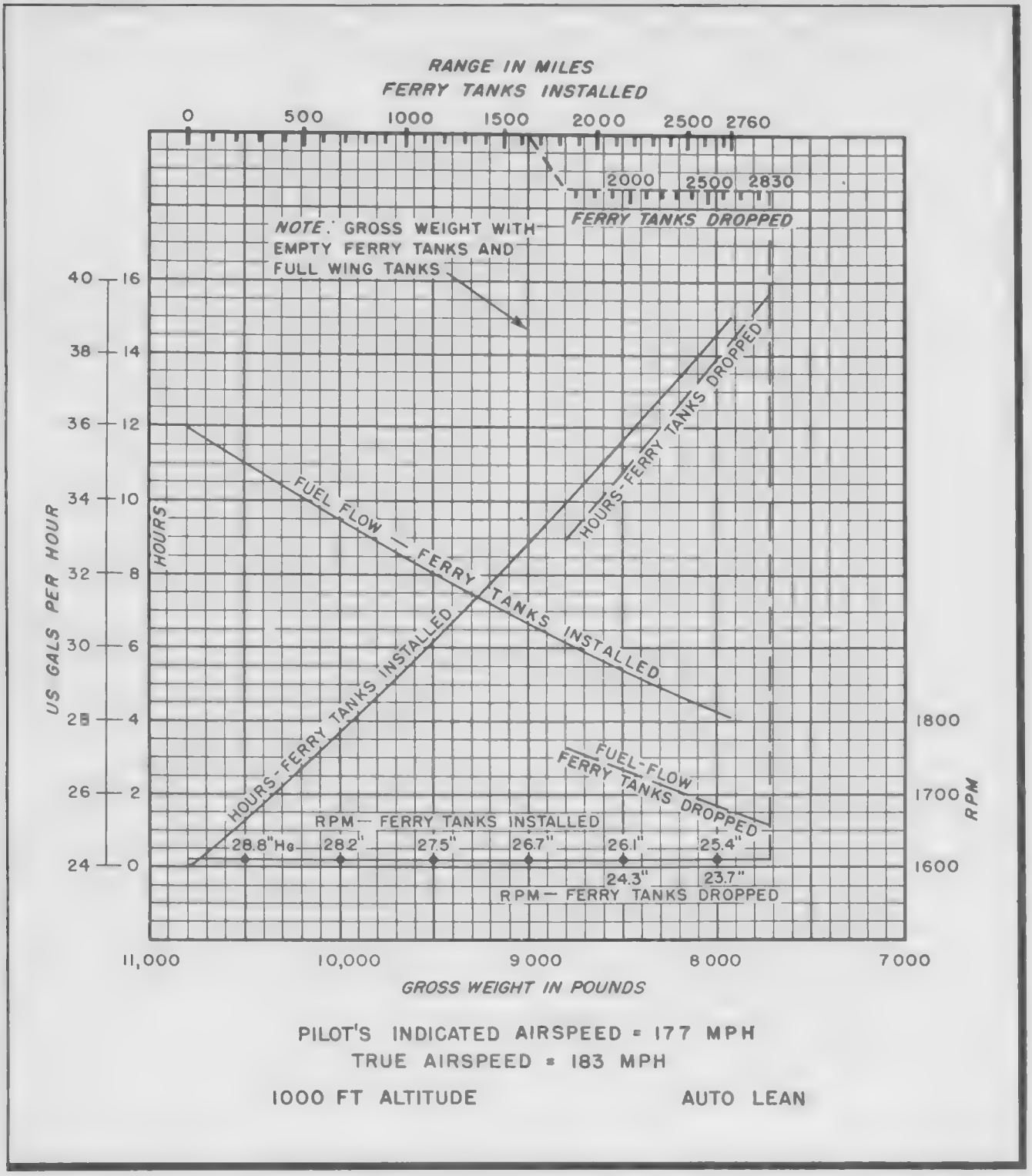


Figure 18 - Long-Range Cruising Chart 177 MPH - 1000 Feet

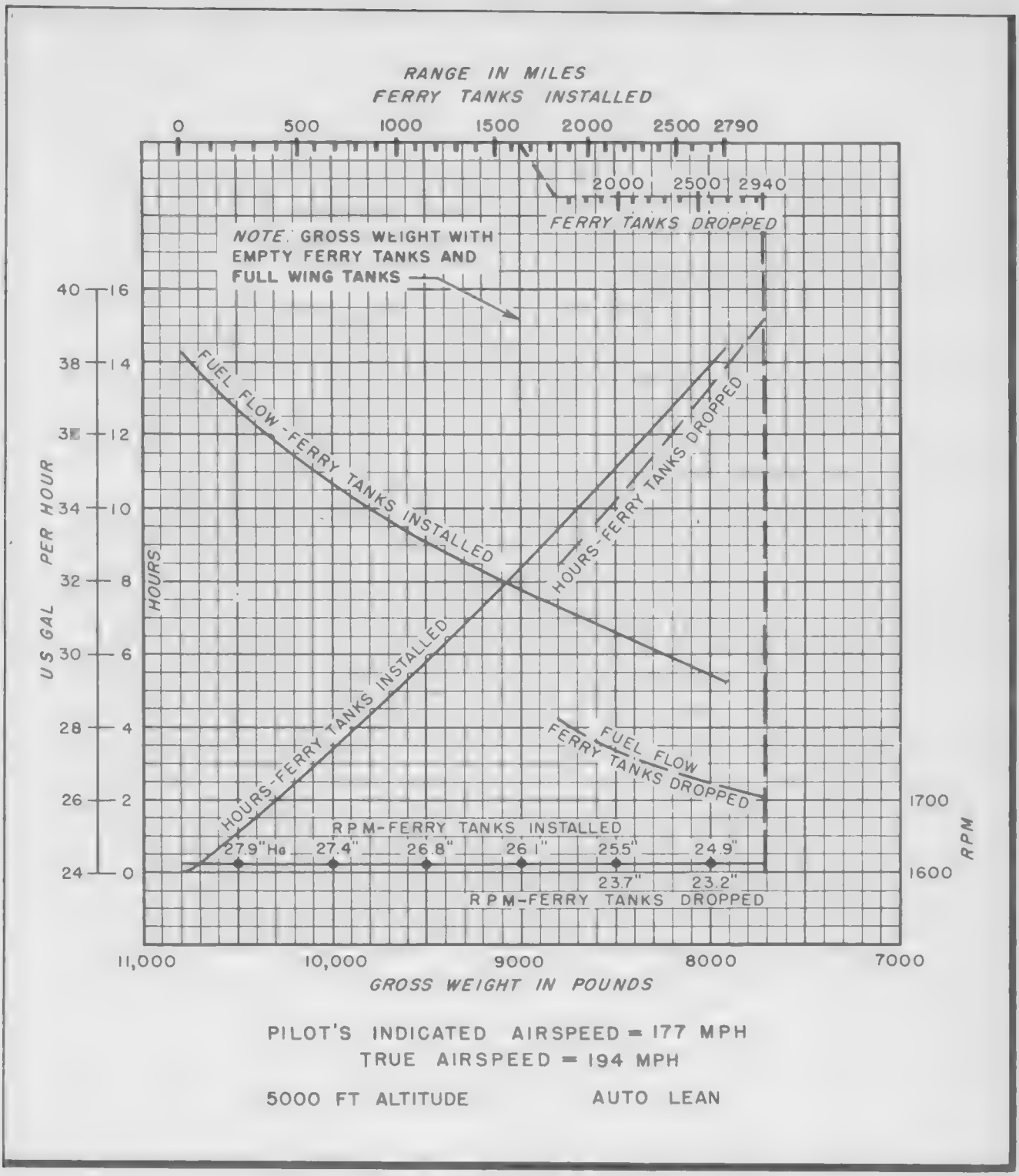


Figure 19 - Long-Range Cruising Chart 177 MPH - 5000 Feet

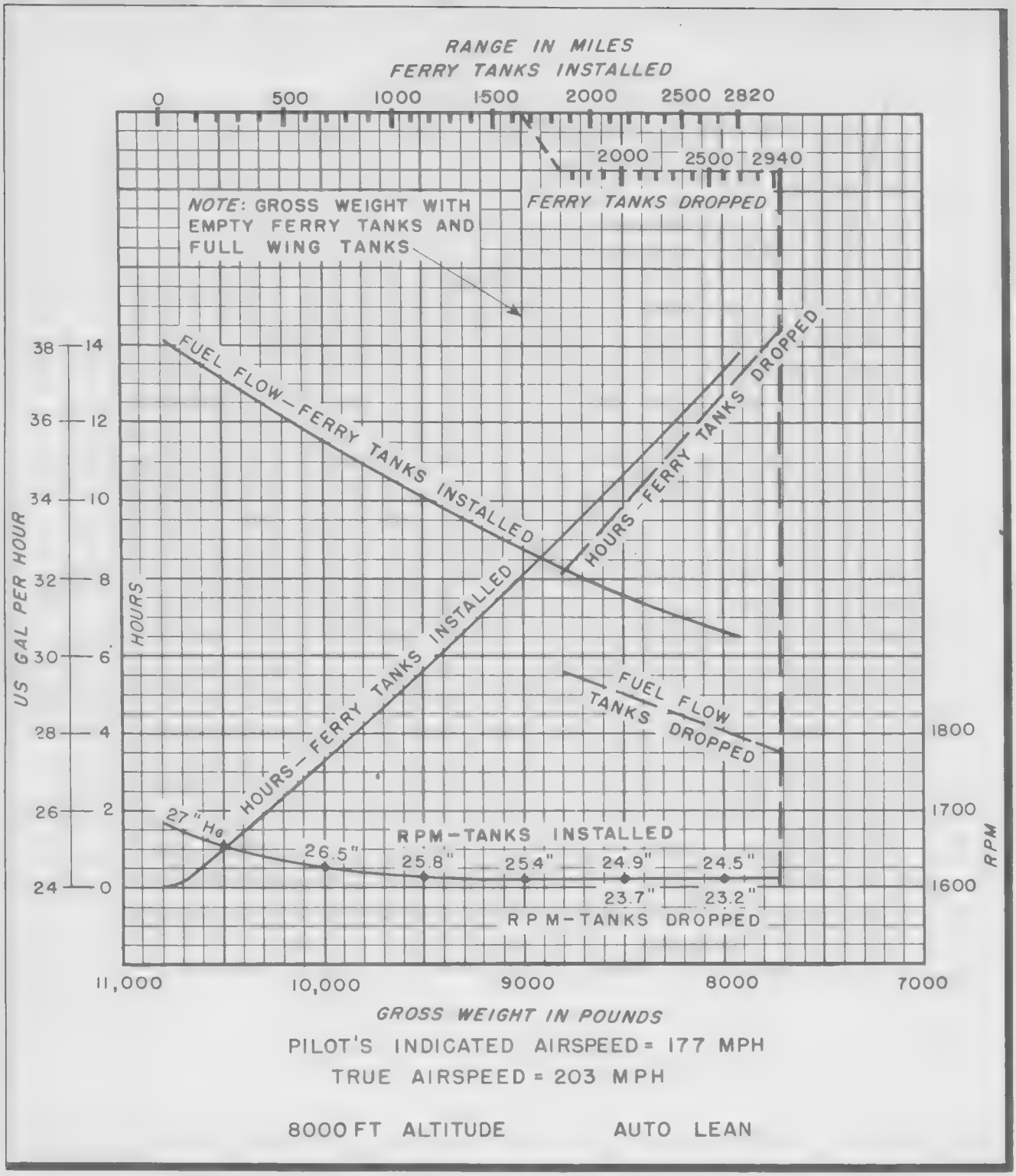


Figure 20 - Long-Range Cruising Chart 177 MPH - 8000 Feet

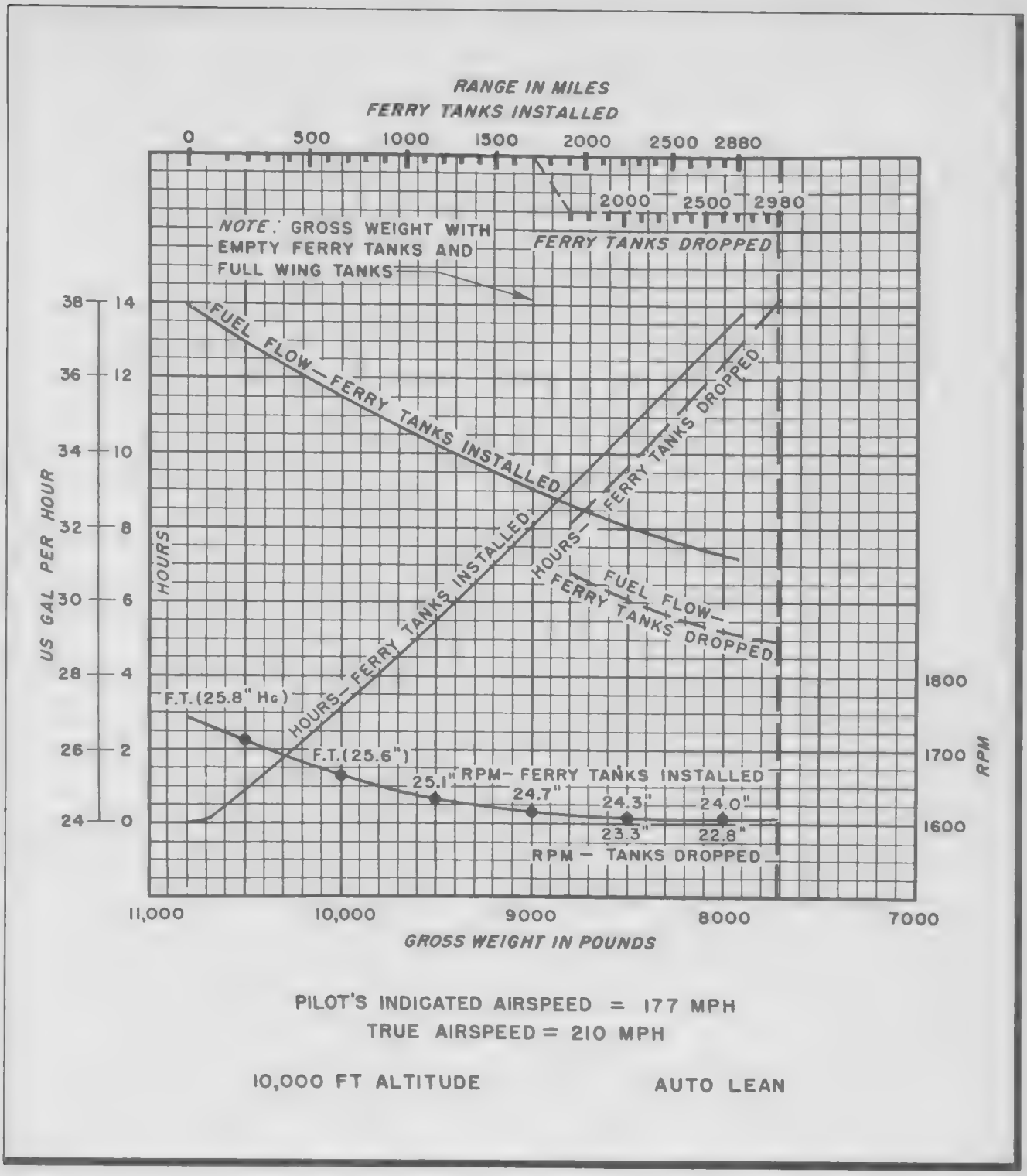


Figure 21 - Long-Range Cruising Chart 177 MPH - 10,000 Feet

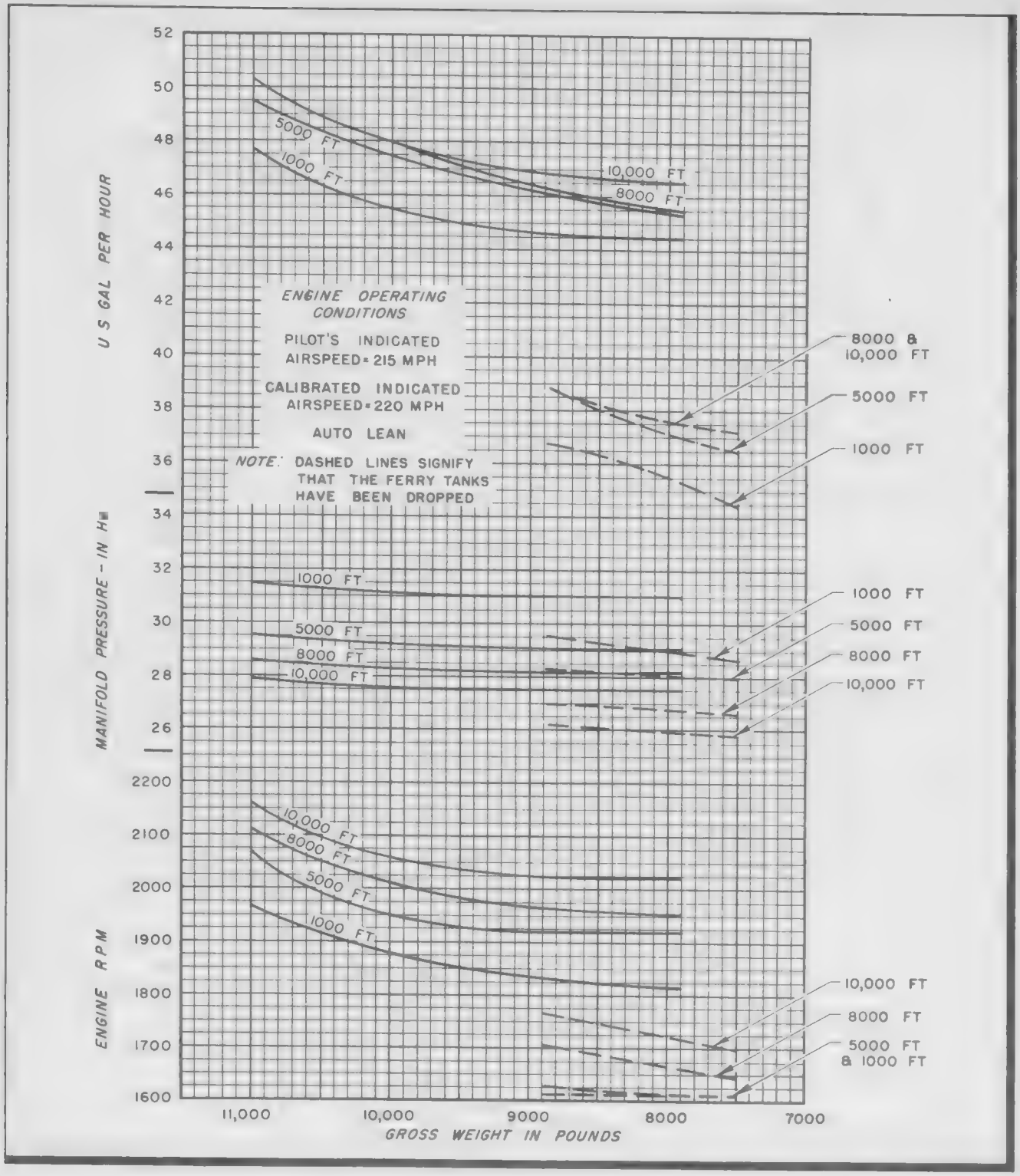


Figure 22 - Long-Range Cruising Chart 215 MPH - All Altitudes

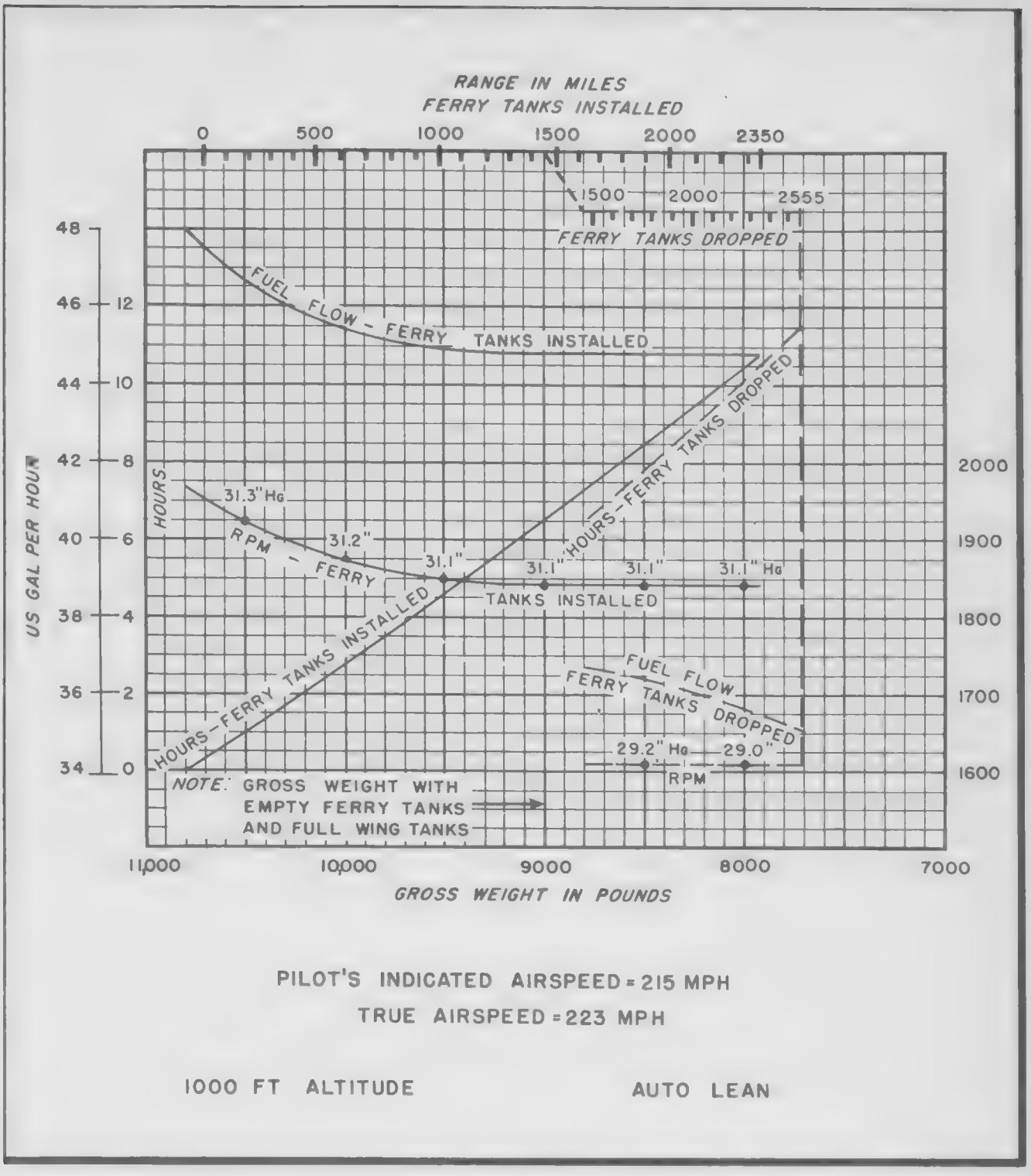
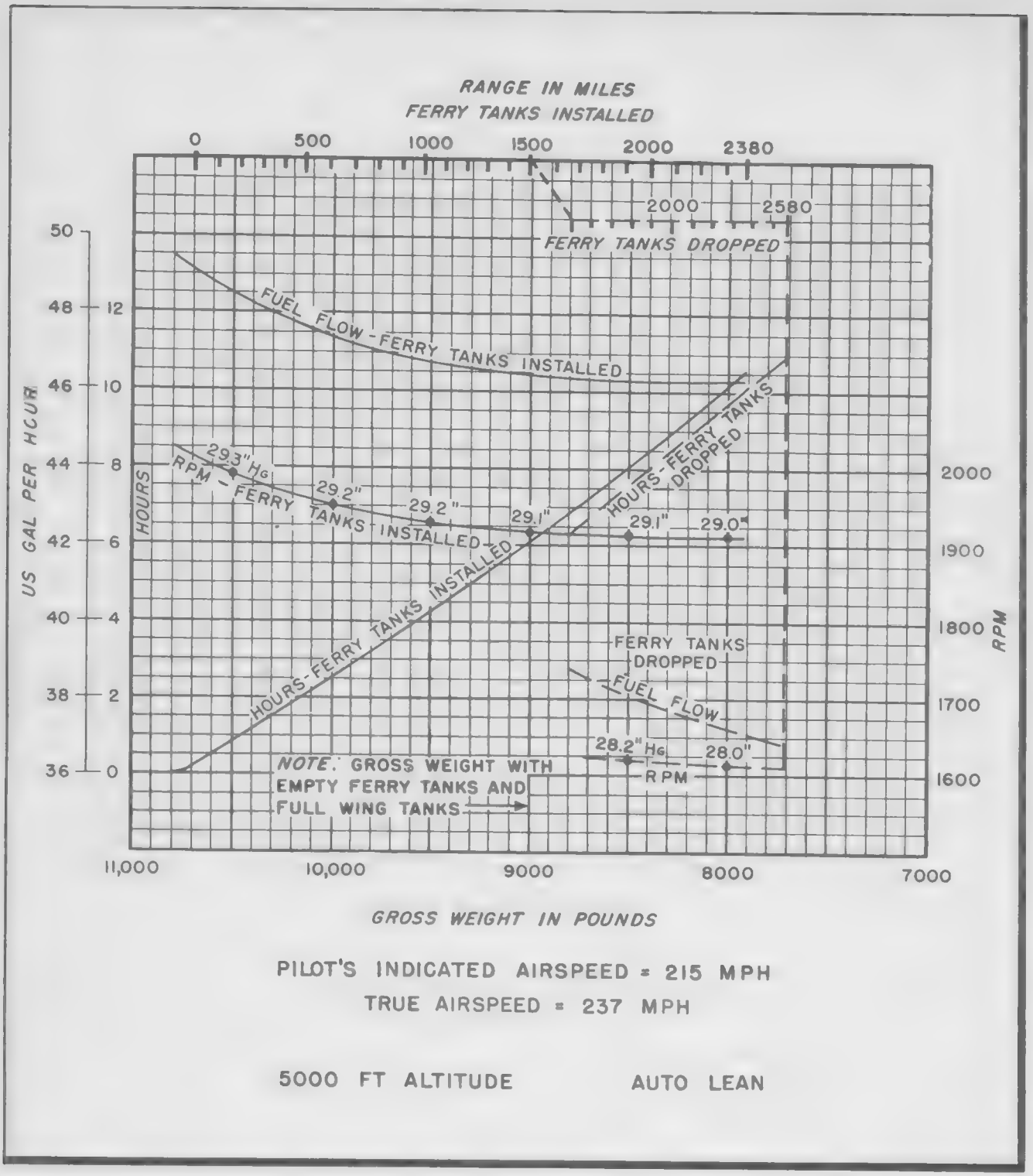


Figure 23 - Long-Range Cruising Chart 215 MPH - 1000 Feet

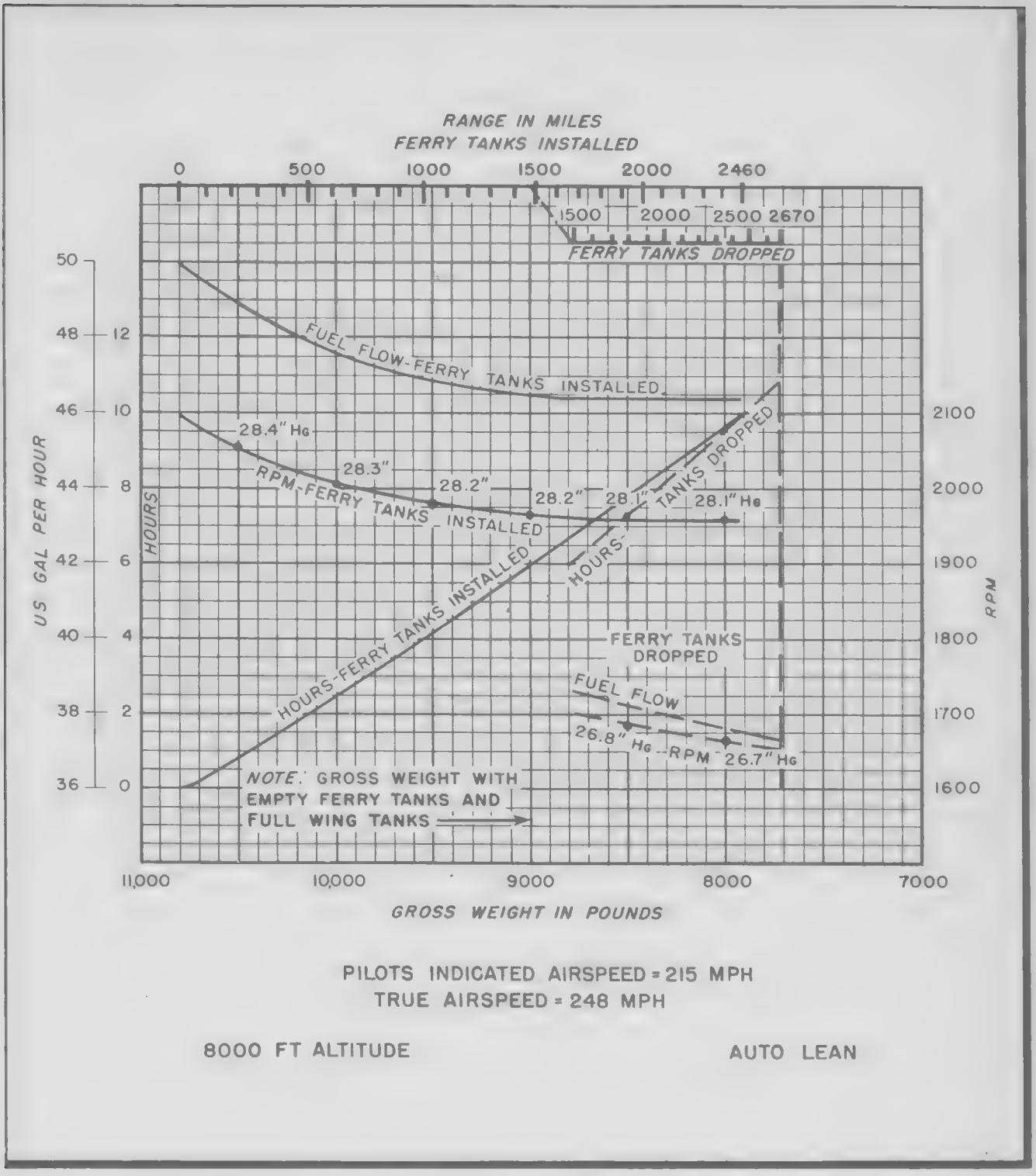


PILOT'S INDICATED AIRSPEED = 215 MPH

TRUE AIRSPEED = 237 MPH

5000 FT ALTITUDE AUTO LEAN

Figure 24 - Long-Range Cruising Chart 215 MPH - 5000 Feet



PILOTS INDICATED AIRSPEED = 215 MPH
TRUE AIRSPEED = 248 MPH

8000 FT ALTITUDE AUTO LEAN

Figure 25 - Long-Range Cruising Chart 215 MPH - 8000 Feet

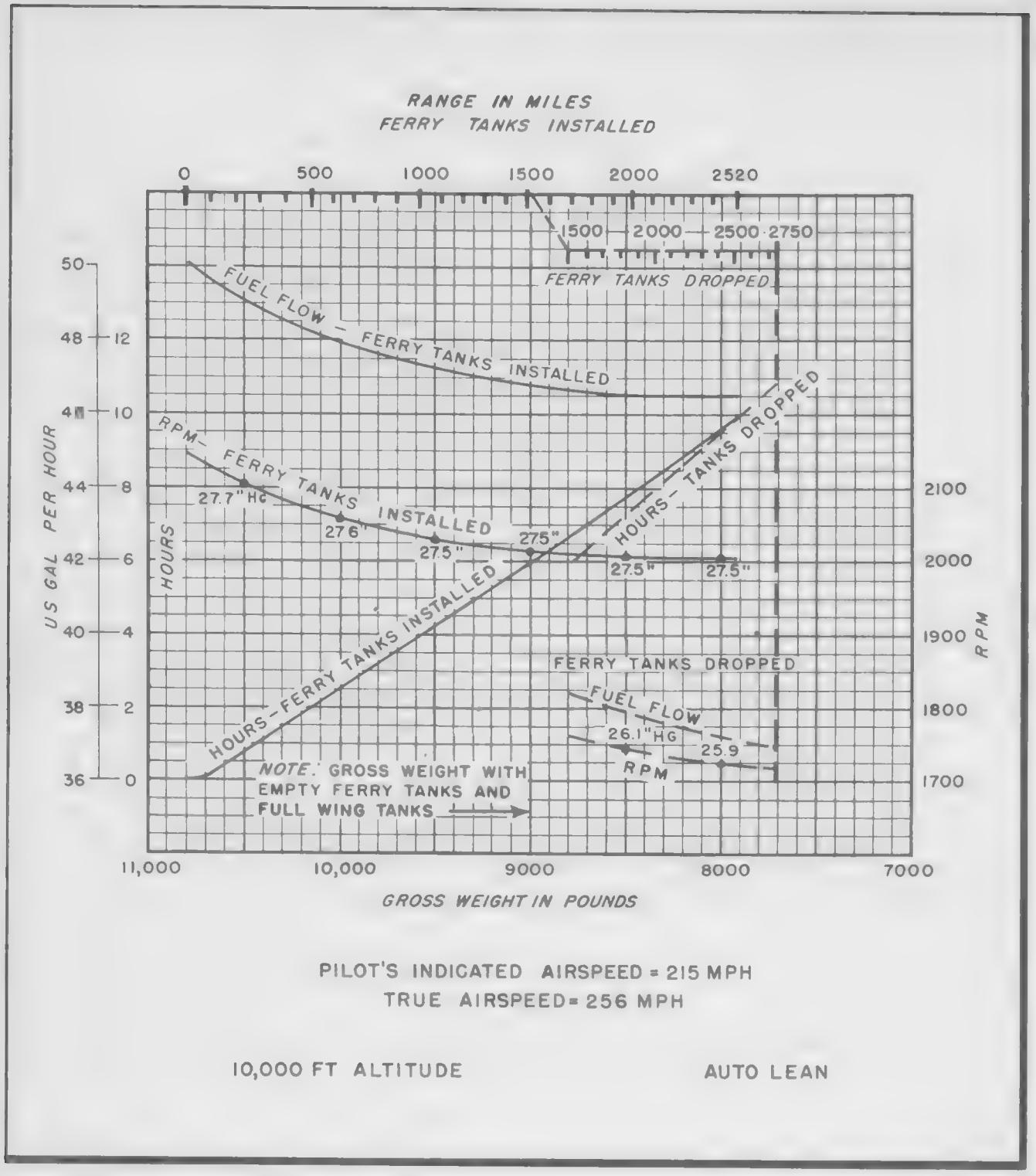


Figure 26 - Long-Range Cruising Chart 215 MPH - 10,000 Feet

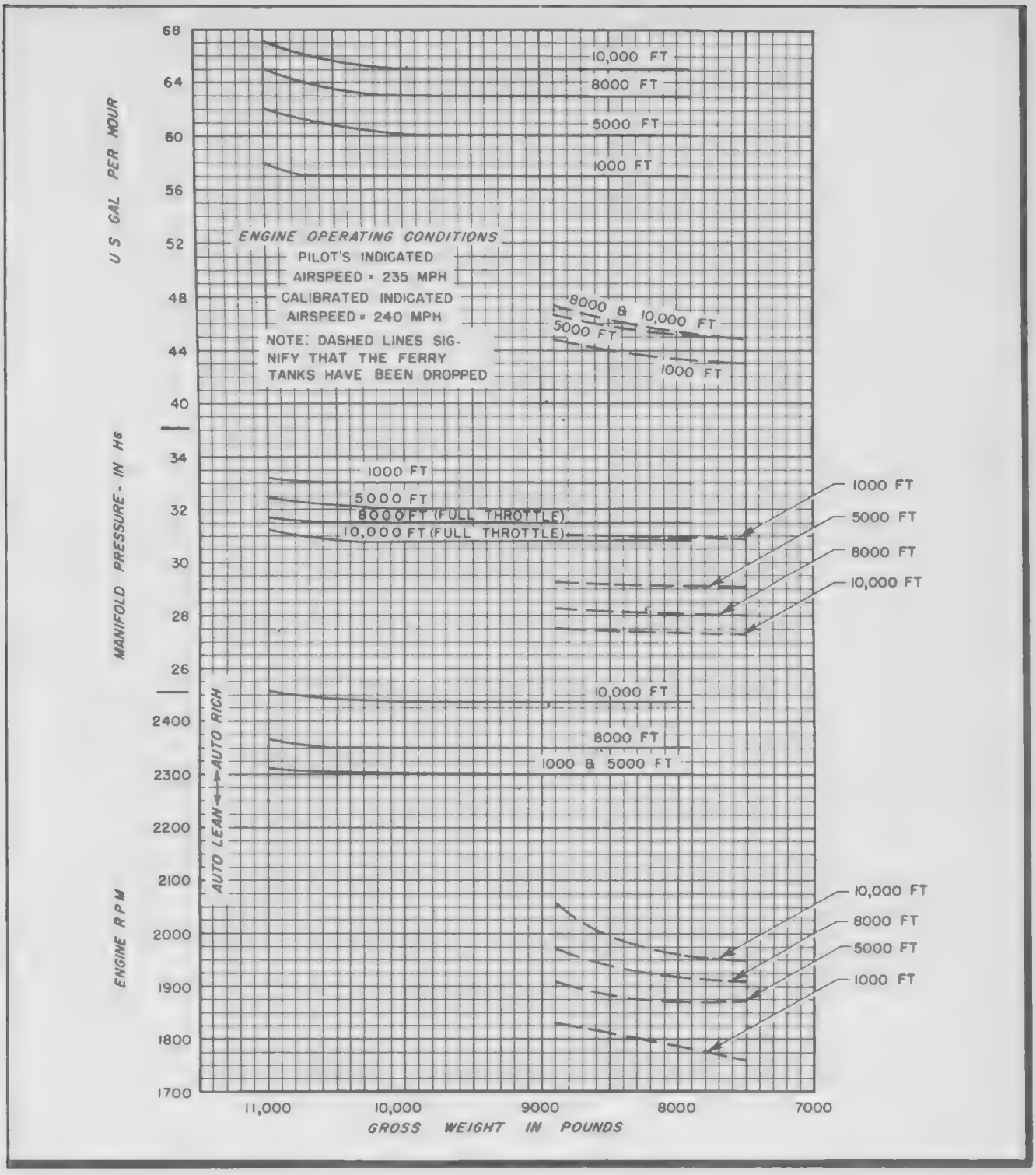
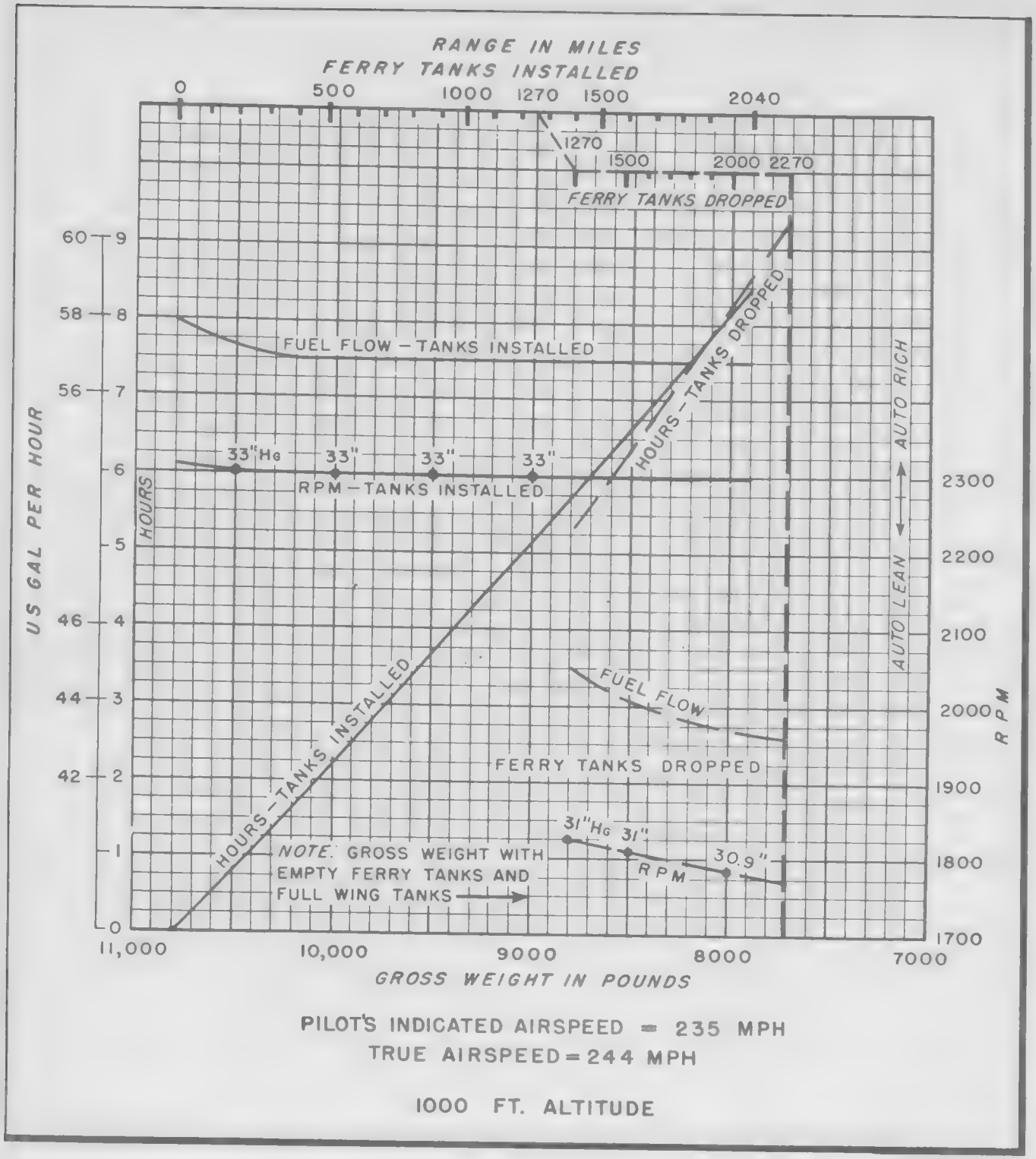


Figure 27 - Long-Range Cruising Chart 235 MPH - All Altitudes



PILOT'S INDICATED AIRSPEED = 235 MPH
TRUE AIRSPEED = 244 MPH

1000 FT. ALTITUDE

Figure 28 - Long-Range Cruising Chart 235 MPH - 1000 Feet

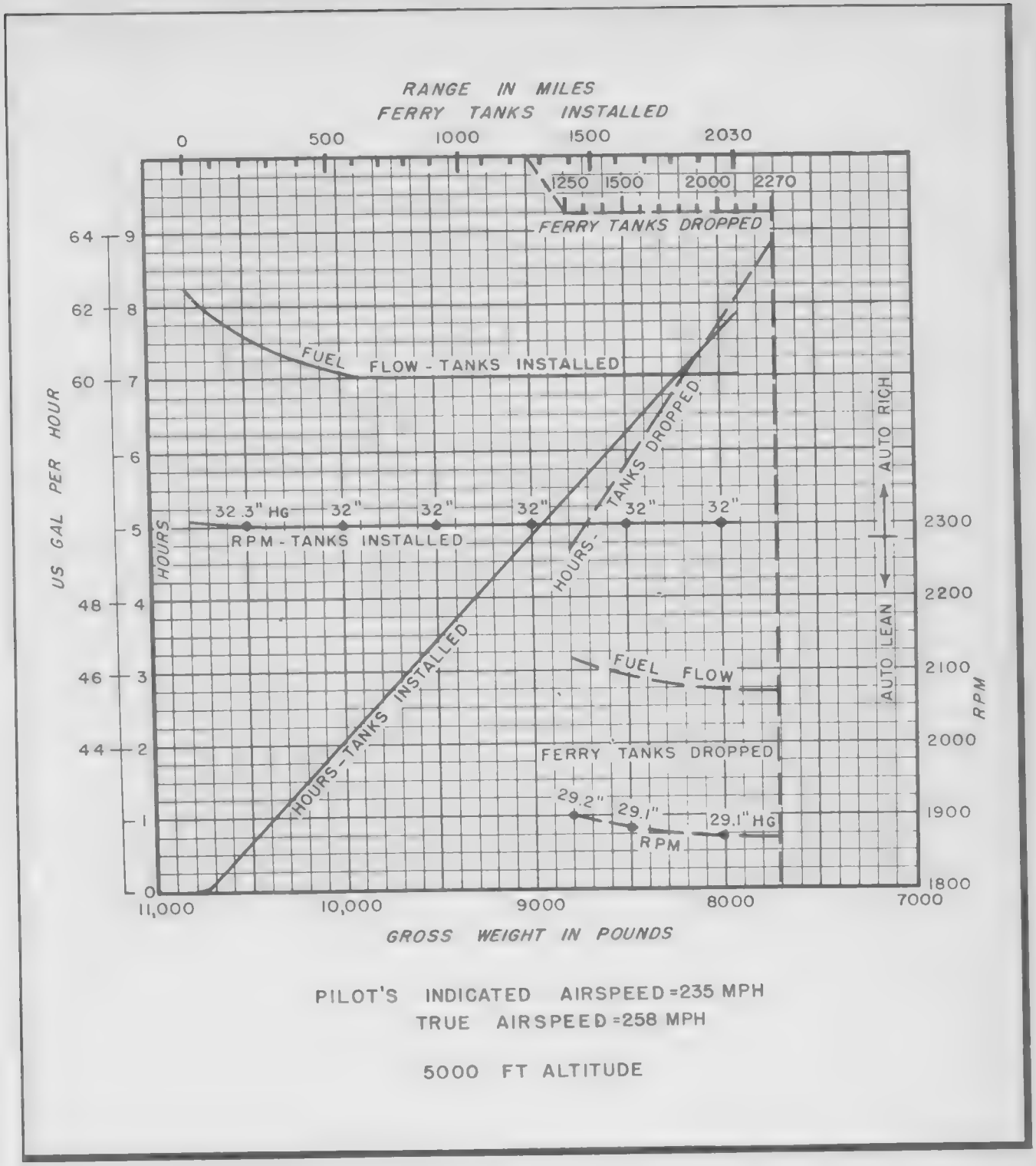
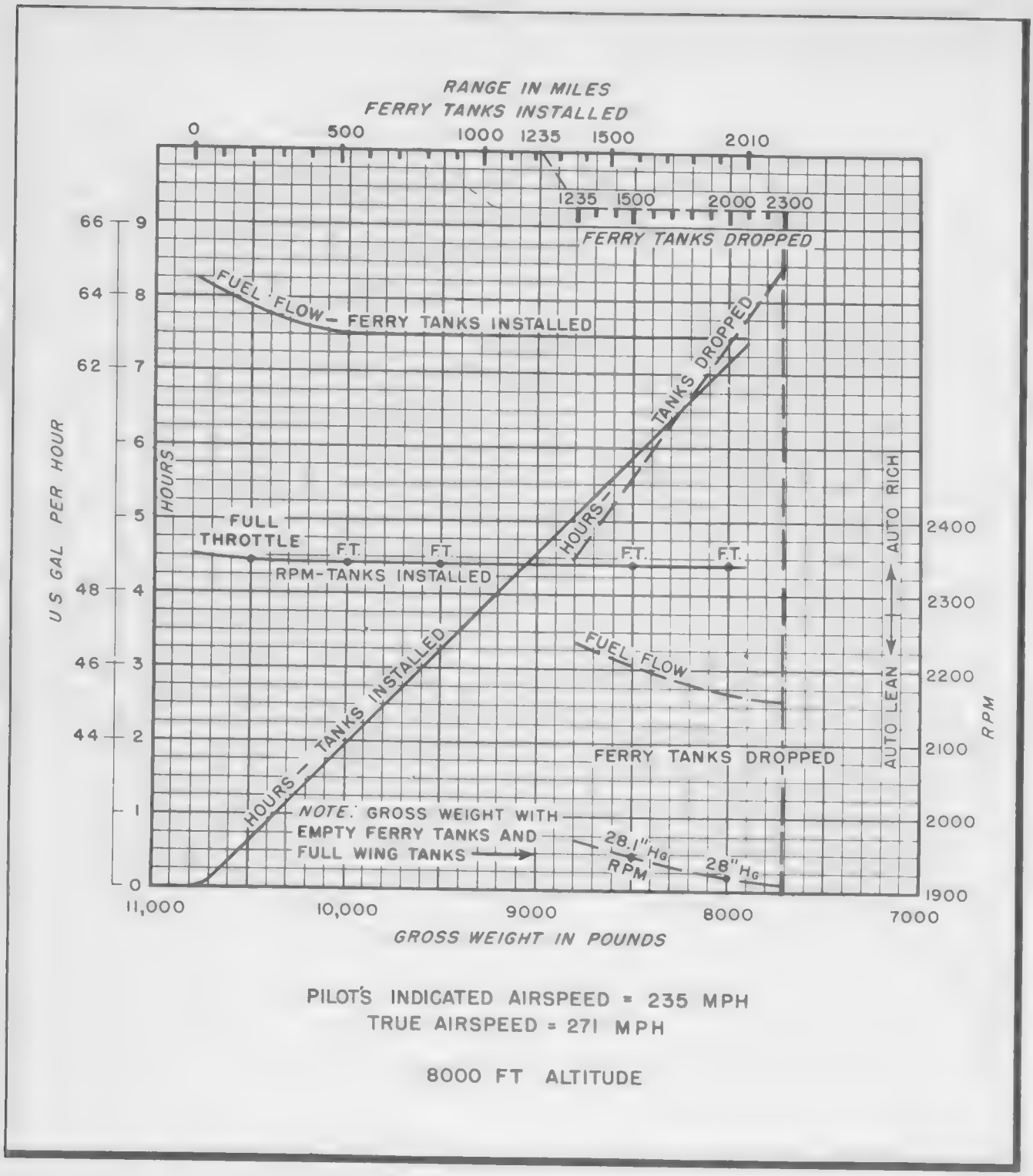


Figure 29 - Long-Range Cruising Chart 235 MPH - 5000 Feet



PILOT'S INDICATED AIRSPEED = 235 MPH
TRUE AIRSPEED = 271 MPH

8000 FT ALTITUDE

Figure 30 - Long-Range Cruising Chart 235 MPH - 8000 Feet

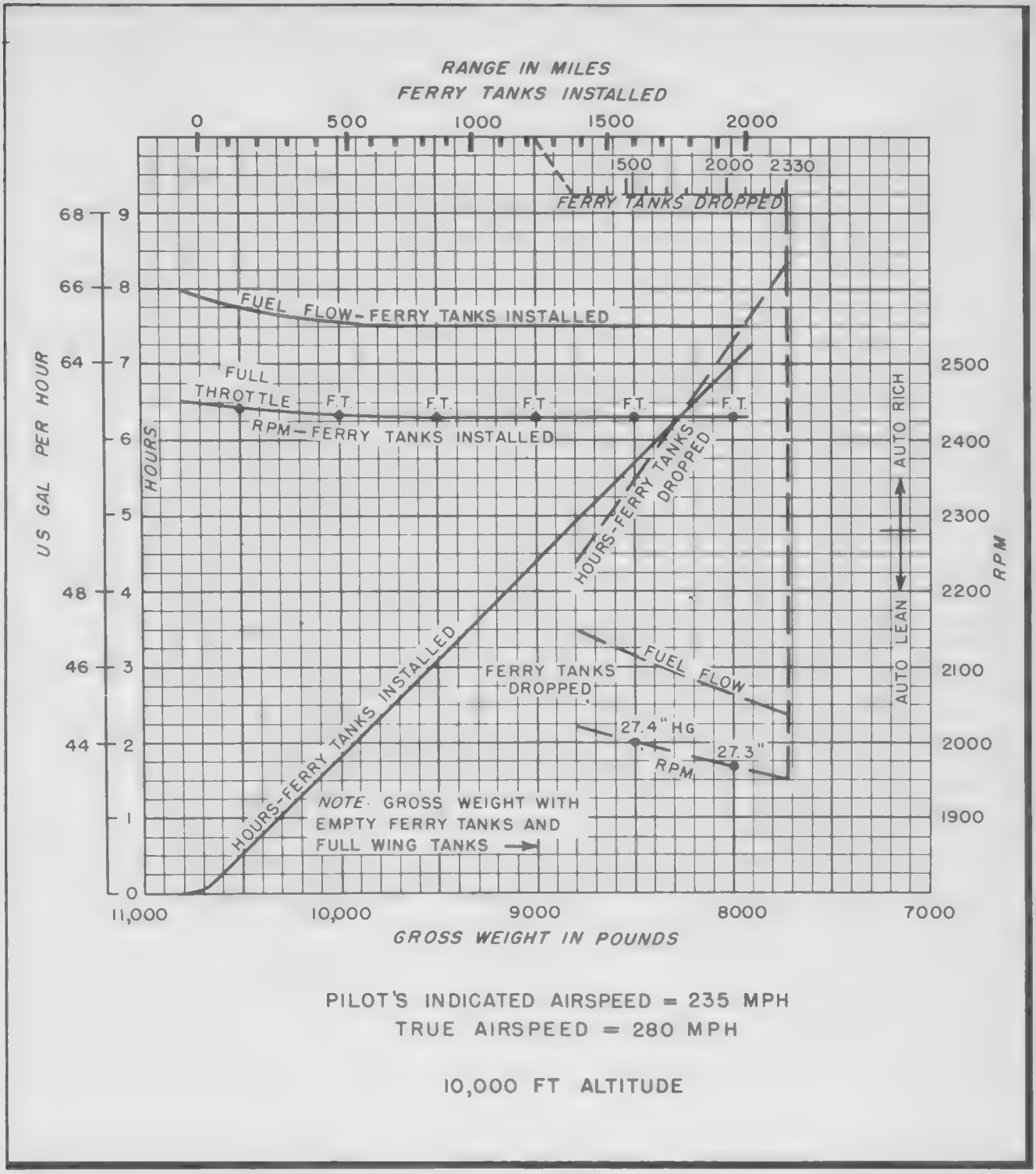


Figure 31 - Long-Range Cruising Chart 235 MPH - 10,000 Feet

APPENDIX II

U. S. A. - BRITISH GLOSSARY

	U. S. A.	British
1.	Airfoil	Aerofoil
2.	Airplane	Aeroplane
3.	Armor	Armour
4.	Battery	Accumulator
5.	Caliber	Calibre
6.	Carburetor	Carburettor
7.	Center	Centre
8.	Cockpit Enclosure (Canopy)	Cockpit Hood
9.	Control Stick	Control Column
10.	Empennage	Tail Unit
11.	Fire Wall	Fireproof Bulkhead
12.	Horizontal Stabilizer	Tail Plane
13.	Landing Gear	Undercarriage
14.	Left	Port
15.	Left Wing	Port Main Plane
16.	Lines	Pipes
17.	Maneuver	Manoeuvre
18.	Manifold Pressure	Boost
19.	Shock Strut	Oleo Leg
20.	Nose-Over Structure	Overturning Pylon
21.	Propeller	Airscrew
22.	Radio	Wireless
23.	Right	Starboard
24.	Right Wing	Starboard Main Plane
25.	Surface Control Lock	Locking Gear
26.	Surface Controls	Flying Controls
27.	Trim Tabs	Trimming Flaps or Tabs
28.	Vertical Stabilizer	Fin
29.	Wing	Main Plane
30.	Wing Tips	Plane Tips

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